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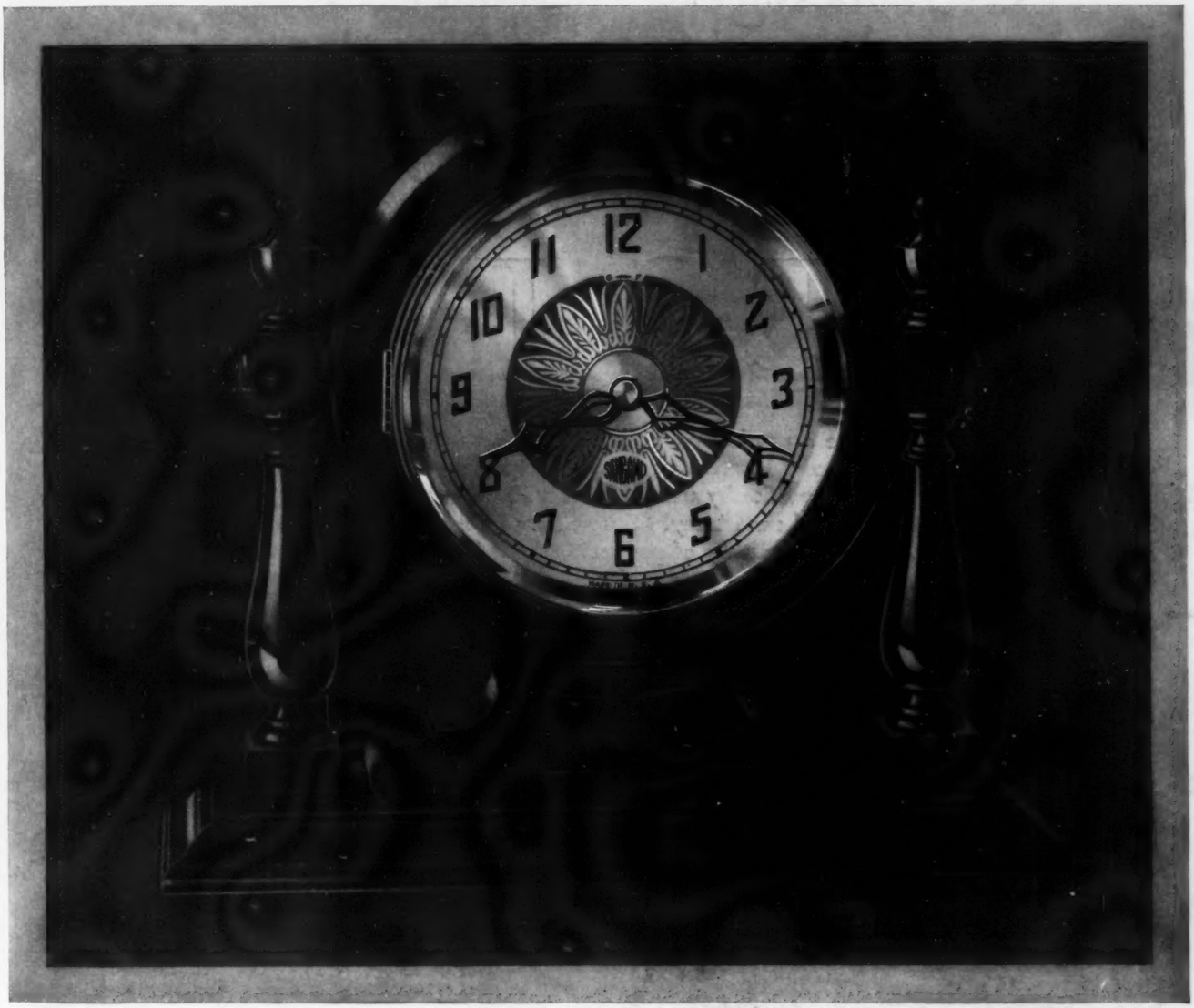

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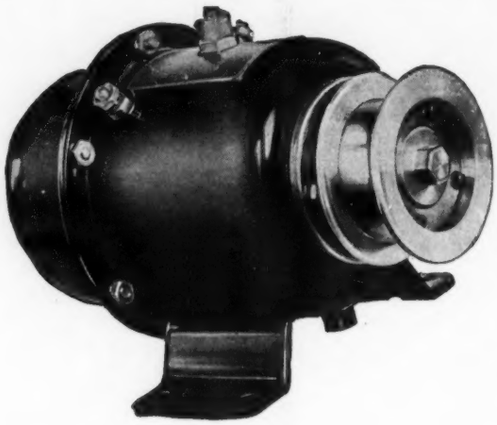

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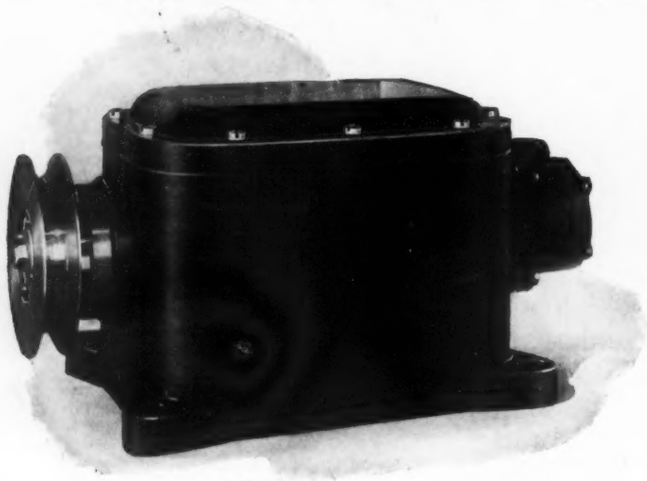

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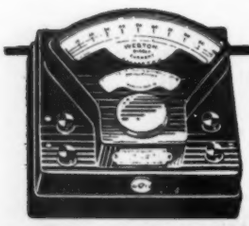

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Electrical World

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Contents of This Issue

Editorials 739

Frontispiece—Beginnings of New York's Largest Power Station 742

Hydro-Electric Construction Practice on Pacific Coast 743
Road building, transportation, organization, housing and feeding, job equipment and construction methods on the Balch hydro-electric development are discussed.

Installation of Turbines at Edgar Station . 746

Step-Induction Regulator-Controlled Synchronous Converters 747
BY M. F. PACKARD
Automatic operation and the absence of the usual starting apparatus are features of this type of converter control, a description of which is given by the author.

Utility Courses Inaugurated at Northwestern and Illinois 750

Hydro-Electric Progress in Spain 750

Rochester Utility Building Has Many Automatic Devices 751
BY KATHRYN L. SHATTUCK

New Hydro-Electric Stations in Italy ... 752

Requirements of Oil Switch Operating Mechanisms 753
BY ROY WILKINS
High speed of break, minimum power input and low cost are important factors, says the author, and he gives a description of the stored mechanical energy device.

Removing Seasonal Slump from Residence Business 755
BY W. S. LEFFLER

Letters from Our Readers 756

Central Station and Industrial Practice .. 757
Rotor Skew of Small Motors 757
Interlocked Conveyor System Pays Its Upkeep .. 757
Cost of Making Some Meter Operations 758
Automatic Pumping in Pickle Plant 758
Melting Brass in the Electric Furnace 758
Cooling System for Theater 759
Conjectures and Speculations 760
Montaup Construction Costs 760

Commercial Activities and Public Relations 761
Lighting Consciousness and Better Market Development 761
Back to Business 761
How the Detroit Edison Portrays Expenditures .. 762
Public Utility Has Own Printing Department ... 762
"Electric Power Cable—The Industrial Life-Line" 763
Consumers Power Participates in Reforestation . 763

Digest of Electrical Literature 764

New Books 766

News of the Industry 767

Men of the Industry 775

Court Decisions, Commission Rulings ... 776

Financial and Corporate 777

Manufacturing and Markets 781

Activities of the Trade 784

New Equipment Available 785

Construction News 786

Electrical Patents 788

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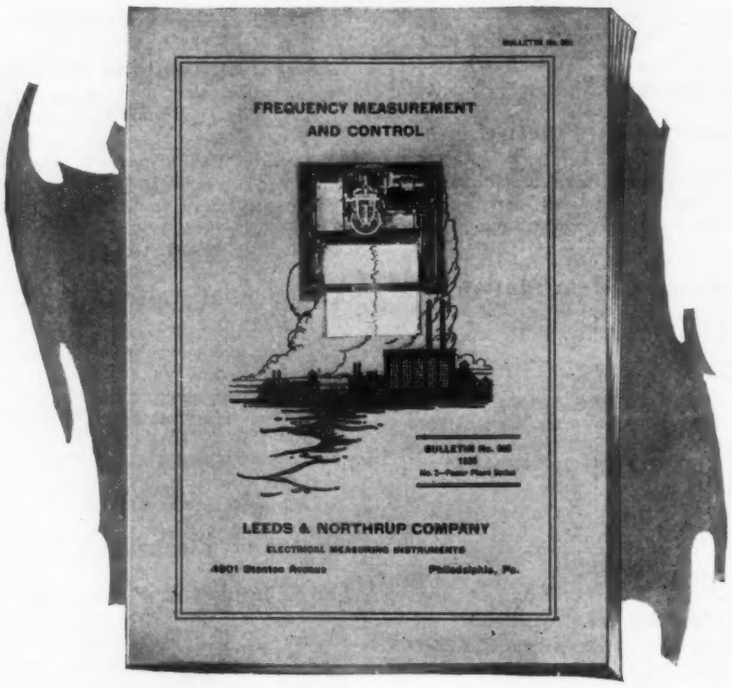
A NEW METHOD

Of Recording Frequency



BULLETIN NO. 985-W, issue of 1926, describes the new L & N Frequency Recorder, of which advance announcement was made in the 1925 N. E. L. A. Meter Committee report. Extremely sensitive, it records on a very open scale.

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 88 — *New York, Saturday, October 9, 1926* — NUMBER 15

Labor Recognizes that Production Is the Measure of Wages

LABOR now recognizes that wages depend upon production. This idea is embodied in the opening address of President Green of the American Federation of Labor at the current Detroit convention. He advocates the five-day week for those industries prepared for it and intimates that the shorter week will come only if labor becomes more productive. This is a wholesome change in labor philosophy and embodies the principle that higher wages and shorter hours must be based upon increased productivity in industry and not be a charge on capital.

A policy of intensified production announced by labor should give every incentive to the light and power industry to sell electric service and equipments. Electrical men can do much to change industrial processes so as to insure greater production by selling the machines, ovens, conveyors, control devices and other equipments that have been developed for this purpose. Electrical power has proved to be the primary and versatile tool to give greater production per worker in many industries. With the experience gained in the past there is no doubt that light and power companies will continue the big task of electrifying American industries and thereby giving to both labor and capital increased returns on their respective investments.

Joint Regulation Urged in New England

A SIGNIFICANT step away from federal regulation of interstate transmission of power was taken two weeks ago by the New England Council, which met at Bretton Woods, N. H., by the unanimous passage of resolutions advocating voluntary joint regulation of utilities by the commissions of the states concerned in intercompany agreements crossing state lines. A report of this action was printed in last week's issue. It is noteworthy that the plan proposed provides for the voluntary submission of the companies involved to joint regulation and that the varied interests composing the New England Council are all agreed that joint state regulation should be established rather than regulation by any agency of the federal government. This is a real achievement, for the council represents six most individual states, including their respective governors, public utility commissions, business interests of the greatest variety and, finally, the power industry itself, all working together for the common good. Fine indeed is the leadership which works so effectively in so worthy a cause, and it would be wonderful if the industry the country over would unselfishly back such efforts to establish co-ordinated regulative stability and mutual understanding.

The trend of the times is toward greater and more powerful public utility groups, spreading over many state lines, and while the excellence and lower cost of the service amply justify such co-ordination, it is vain to hope that some authority greater than that of the state will not some day try to step in and assume the right to regulate the interstate business. The closer regulation keeps to the properties regulated and the more responsive it is to local appeal the better. Obviously no bureau in Washington would be half so acceptable as a body of commissioners organized on the plan suggested by the New England Council.

Business Principles in Commercial Developments

THE commercial job of the light and power industry is linked intimately with the executive tasks. The articles by Colonel C. F. Lacombe in recent issues of the ELECTRICAL WORLD are very convincing and informative. They show that the motivation of commercial efforts must be based on a business analysis of each utility. At different stages of growth weaknesses may appear in different classes of business, and executive direction based on exact knowledge of all phases of the operations is needed to guide commercial efforts.

Utility cost analyses seem to be logical and necessary at this stage of utility development. They give health charts for executives and show them where commercial efforts should be focused. They also are guides to rate formulations whereby any possible new business can be weighed on the scales of profit and loss in terms of the rate necessary to get the load. Every executive and commercial man should be much interested in the articles of Colonel Lacombe, as they open a very attractive and thoughtful approach to the profitable development of commercial opportunities.

The Great Lakes Section Convention

HUMAN activities are sometimes benefited by a pinch of pessimistic salt, and never is that need so urgent or so little apparent as in times of prosperity when the land flows with milk and honey. In his presidential address to the sixth convention of the Great Lakes Division of the National Electric Light Asociation A. C. Marshall, ordinarily one who sees the sun shining every day, did a little poking around in the shadows, and he found things—only little goblins and monsters now, it is true, but capable of growing rapidly and enormously if they get the right kind of food. The worst of these embryo monsters is the one that grows the fastest; it is the natural and widespread disposition to personal extravagance and laziness which to many is the end and aim of prosperity. Another goblin working in darkness is known as "easy money." This one mortgages the future, and we are liable to wake one day to find him grinning at us. Capital expenditures

based on earnings that fail to grow and sometimes even shrink, purchase prices not justified by physical values, organization expenses beyond operating requirements—all these and many others are the manifestation of the "easy money" monster. It is evidently Mr. Marshall's opinion that the industry cannot afford to turn a deaf ear to the warning of Little Orphant Annie against "the gobble-uns 'at gets you ef you don't watch out."

Another man who spoke right out in meeting, perhaps to the scandal of some of the congregation, was R. F. Pack, president of the N.E.L.A. Mr. Pack arose at the banquet and shot home a few body blows to any too complacent diners. He said that the proper way for the electric utilities to have good public relations was for them to live good public relations. He intimated that in this matter there was more talking than living. He even had the temerity to declare that praise and appreciation of the accomplishments of the industry sounded better as coming from outside than from inside the industry. The remarks of these two men, plus many profitable addresses and papers at the sessions, should be assurance that each delegate carried home from the convention more than just his golf score and the remembrance of pleasant social events.

The "Free Lance" Jobbers

IN ANOTHER week the members of the Electrical Supply Jobbers' Association will gather at Atlantic City for their annual fall convention. But there will be a new voice in the chorus this time. The "free-lance" or "independent" jobbers—so called to distinguish them from the other members of the association, who belong to the General Electric, Westinghouse or Graybar groups—are holding a special meeting in advance of the association sessions. The purpose of this meeting will be to discuss the position of the "independent" jobber and to crystallize his point of view, that it may be more definitely expressed in the councils of the industry. Just what this point of view may be—and, in fact, whether or not the "free lance" actually has any serious problem other than those common to all jobbers—is probably indefinite in everybody's mind.

Since this meeting of the independents was suggested a while ago, however, some men have wondered if it meant the coming of a breach in the jobbing industry and a crisis in the affairs of the E.S.J.A. Are the "free-lance" men to be at odds with the three controlled groups? Nothing could be less necessary or more foolish, and if there is any such thought in the mind of any "free-lance" jobber, this meeting will serve well to clarify his thinking and to bury the idea. For such frank discussions are ever a healthy influence. The other allied groups have their own meetings at other times. There is no reason why the "independents" should not hold a similar group meeting to talk over any issues that may be of particular interest to them. And such a meeting need reflect no whit upon their loyalty to the E.S.J.A., nor upon their broad, unselfish interest in the welfare of the electrical jobbing industry as a whole.

The important point is this—that no affiliation between any manufacturer and his distributors nor between a great national organization like Graybar and its branches can alter the fact that the fortunes of every jobbing house, no matter what its allegiance or its locality, are ruled by economic law and not by politics. The problems of warehousing, the need for accurate knowledge of the market, the importance of detailed statistics on the costs of distribution and the absolute necessity for efficiency and enterprise in selling are common to all electrical jobbers, both the "controlled" and the "free." It has long been obvious that a general understanding of certain principles and the acceptance of certain sound basic policies are vital to the prosperity and progress of the whole jobbing industry, and knowledge of this fact has long held these scattered local and regional supply companies together for mutual help and guidance. The common need of all for broad industry organization will not be lessened because the "independents" elect to have a little side party of their own, for group meetings have come to be the fashion.

Taking up Commercial "Slack" in Utility Transfers

TO MAINTAIN normal efficiency of operation during transition periods in plant development is often a difficult problem. It has its parallel in the commercial department when a property under centralized management passes into the control of another syndicate. Sometimes several months elapse before the administration of a light and power company which has changed hands "finds itself" and becomes adjusted to the new régime in policies and methods, even if the local personnel undergoes comparatively small change. It is very important to take up what might be called the commercial "slack" in situations of this kind.

Many local properties under centralized management depend not a little upon headquarters specialists for commercial development. In a typical case a vigorous industrial lighting campaign may have been waged in a community under the former headquarters management. The local company may have been too small to carry on its own payroll the specialized talent needed to develop this particular business in a broad way, although its sales forces may have co-operated diligently in the survey, canvassing and installation work. Along comes a new management at headquarters. What happens to the drive for industrial lighting under the former direction and how may the impetus to develop this particular class of business be kept up and increased?

Obviously, it is most important for the company to capitalize all the work done by both headquarters and local sales forces, striking while the iron is hot and avoiding the pitfalls of interrupted new-business solicitation. Provision should be made during the transition period to carry on all sorts of commercial development which is succeeding. This is a matter which deserves full consideration in conference between the old and the new centralized managements. Details must be worked out as the local situation requires, but a progressive management will not hesitate for a moment to adopt even such measures as retaining on a fee basis the sales engineering services of the old organization long enough to build up or to train a new staff if needed to carry on the good work previously accomplished. For a fair consideration one headquarters organization will often sell specialized service to its successor, certainly until the latter gets on its feet, becomes closely acquainted with the territory and the

customers, and can take over the industrial lighting or other commercial drive without slowing down the rate of load building. Local interest in industrial lighting, for example, grows with each new or improved installation, especially in regions where one or two major industries are being electrified. To keep this interest at top pitch there must be no more commercial slack than is absolutely unpreventable in transferring a property from one management group to another, and the fact that methods vary between such organizations should not be allowed to impede load-building progress for a single week in the period of control transition.

What Is a 250,000-Kw. Turbo-Generator?

WHEN the expression "turbo-generator" meant a single turbine driving a single generator, a rating of so many horsepower, kilowatts or kilovolt-amperes had some significance. Now, however, when a turbo-generator may range from the old simple classification up to a three-shaft set driving three generators and as many auxiliary generators and exciters, a rating does not have so much significance.

What does a 250,000-kw. or even a 60,000-kw. unit mean? It would suggest a 250,000-kw. or 60,000-kw. generator driven by a turbine, but more likely it refers to the combined rating of a group of main generators and auxiliary generators driven by turbines and normally operated collectively. There is nothing in the present expression or method of rating to indicate whether the rating is that of a single unit or the composite of several ratings.

Aside from the indefiniteness of rating brought about by group units, there is confusion even when individual elements are considered, because they are usually characterized as if they had the combined rating of all the generators on the shaft. If it is only the rating of the turbine which is interesting, this practice is justifiable. But just as frequently, if not more frequently, it is interesting to know the rating of the individual generators that compose the element or group unit without having the rating of auxiliary generators and exciters added in. Present usage in quoting ratings is so ambiguous as to call for further standardization.

Lighting Wanted—Not Merely Fixtures

LIGHTING fixtures are a means to an end—and the end is lighting effect. This statement is so fundamentally a part of the code of the lighting specialist that to him it has become trite. Still, there is evidence on every hand that it is often completely ignored by designers, dealers and purchasers. Primarily the lighting fixture is merely a link in the chain from the meter to the final aim, which is illumination. Being a visible part of this chain, its appearance is important, but appearance too often completely overshadows the lighting effect in the mind of designer, dealer and purchaser. A large percentage of decorative fixtures are designed without consideration of the fundamental principles of adequate and proper lighting.

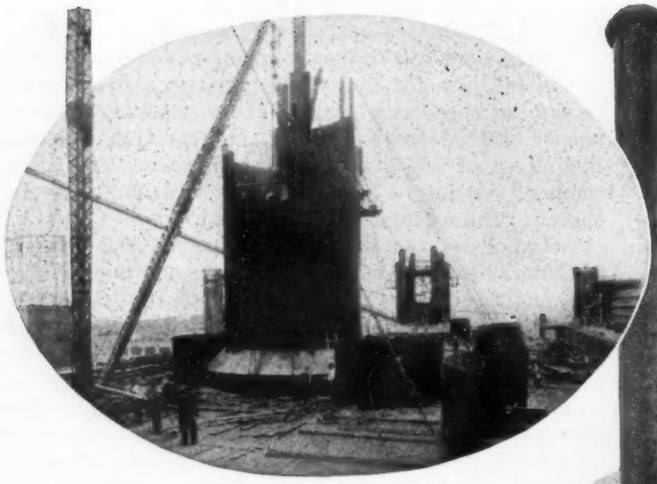
A threatened lawsuit which has come to the attention of the ELECTRICAL WORLD is very suggestive. A certain merchant went to a fixture company to purchase a lighting installation for his rather exclusive shop. Perhaps he did not specifically state that he wanted to purchase proper and adequate lighting, but certainly that was the intent of his investment in fixtures. The fixture company suggested some designs from which one was chosen. The fixtures were made and installed and their appearance was satisfactory. However, the intensity of illumination was wholly inadequate and the merchant was justly indignant. It was not until the lawsuit was talked about that the matter was settled by revising the fixtures so that they did the work for which they were purchased.

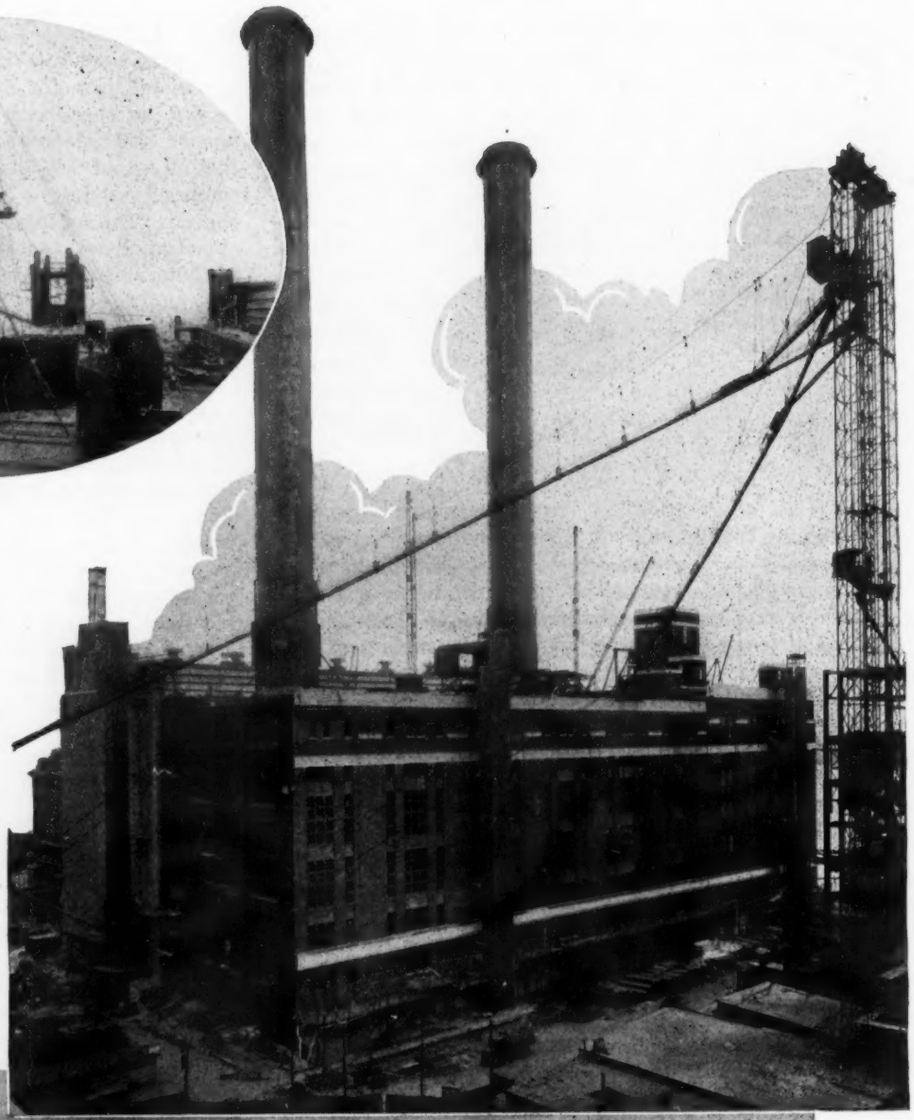
On every hand there exist glaring light sources, improper shades, an inadequate number of sockets and insufficiently diffusing glassware on fixtures. Certainly the user wants proper and adequate lighting even though he does not know exactly what this is. The lighting field is full of potential lawsuits, and if these are not instituted it is only on account of a general lack of lighting education. But the instance cited is rosy with promise. When users of light know what they should have they will preach their own gospel. Then fixtures will be what they should be.

The Trend in Residence Rates

MORE and more electric light and power companies are turning their attention to residence business. The need of simplicity and uniformity in the class of rates offered to householders is gradually being recognized, and the tendency is very pronounced toward a single class of residence rate, with three blocks at unit charges, which will encourage the liberal use of energy. Charges per kilowatt-hour for the first, second and third blocks of energy consumed may vary widely, depending on the system, but the drift is away from high rates on the initial block. For example, instead of 30 kw.-hr. at 10 cents and 100 kw.-hr. at 4 cents with the next 100 kw.-hr. at 3 cents, the rates on the three blocks would be 7 cents, 5 cents and 3 cents respectively. Though the result is approximately the same, the effect on the customer is not, the latter series of rates being viewed by him with more favor.

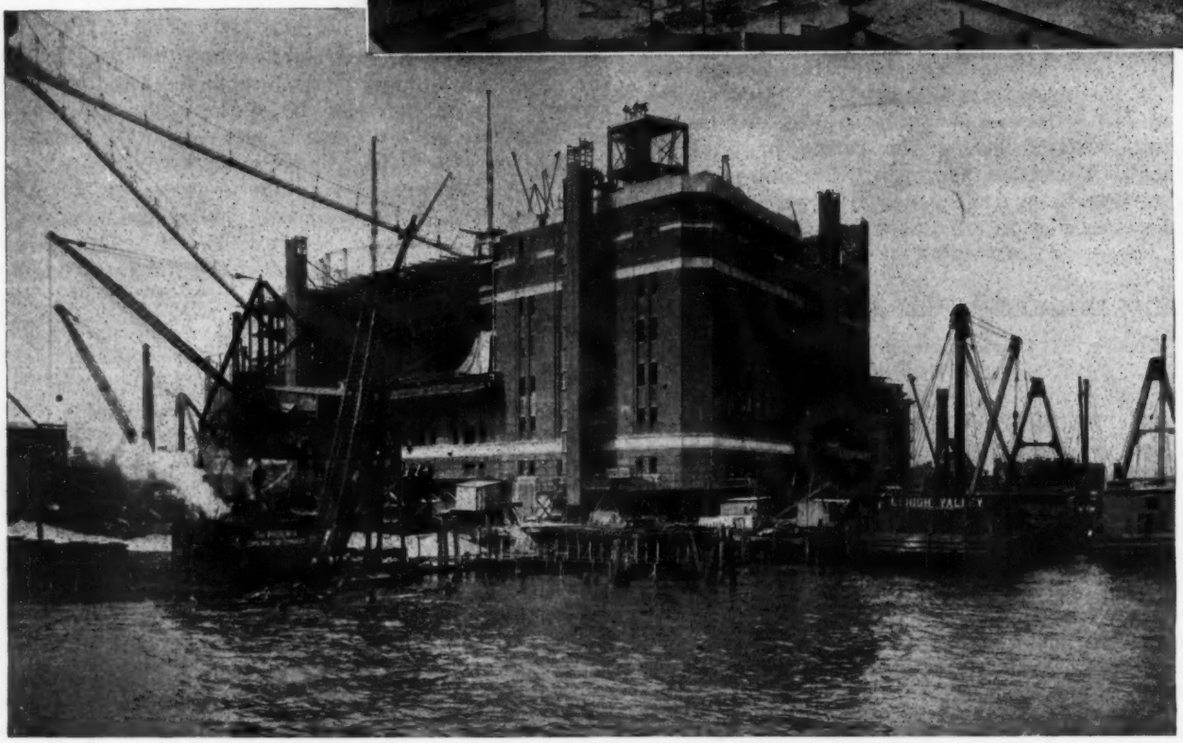
However, the great advantage of the newer form of residence rate is its simplicity and the incentive it offers for state-wide or system-wide uniformity. It is predicated wholly on energy consumption and is not cumbered by other considerations which, however just they may be to the utility company, are annoying and perplexing to the consumer. Moreover, it is gratifying to note that attorneys no longer are able to keep a strangle hold on the residence rate. Too long have lawyers contended for a rate sustainable in law and which no public service commission could therefore set aside. Managers have learned from experience that while it is comforting to have a legal rate, the latter retards rather than encourages the use of electricity in the household. Doubly welcome, therefore, is the movement for mass production and greater use of electricity in the home. It means the emancipation of the housewife from drudgery and the enhancement of the home, and it enables the electric light and power company to render a greater and more appreciated service to the community with profit and satisfaction to both.





Beginnings of New York's Largest Power Station

THE accompanying illustrations are views of the first unit of the new East River station of the New York Edison Company. It is expected that the completed plant will cost in the neighborhood of $50,000,000 and will have a generating capacity of about 700,000 kw. Two 60,000-kw. single-shaft turbo-generators are expected to be in operation before the first of next year.



the generator stator, weighing 35 tons, to the Balch power house

Hydro-Electric Construction Practice on the Pacific Coast

Balch Plant Is Typical of High Head Plants — Road Building, Transportation, Organization, Housing and Feeding, Job Equipment and Construction Methods Discussed

THE Balch hydro-electric development of the San Joaquin Light & Power Corporation was visited by a representative of ELECTRICAL WORLD, and through the co-operation of Harold K. Fox, superintendent of construction, the information on methods and equipment presented herein was obtained. It was found that this project, now under construction, offered an excellent opportunity to bring out the great diversity of problems with which the construction engineer is confronted and to emphasize the necessity for training and experience. In organizing for this work several special problems were encountered, which grew out of the inaccessible and peculiar topographical nature of the country, such as transportation, power and the handling of material on the job. These conditions and the underlying slogan of economy that permeated the entire construction organization gave rise to some unique methods and special equipment new to construction work.

TRANSPORTATION

One of the first considerations was naturally transportation. The site of the Balch power house, which will contain one 33,000-kva. unit operating under a head of 2,381 ft., is 55 miles east of Fresno, Cal., on the North Fork of Kings River, in the heart of the Sierra Nevada Mountain range. Engineers who planned the development had to choose at the outset between a road for motor trucking capable of supporting maximum loads of 35 tons and a railroad. A railroad for the Balch project would have increased the capital costs in transportation facilities by approximately $1,300,000 over what was actually invested in the truck road. The importance of carefully weighing the transportation problem on a Western hydro-electric project will be better appreciated perhaps from the fact that the capital cost of the transportation system frequently runs in the neighborhood of 5 per cent of the total cost of the completed development. One of the accompanying illustrations shows some of the difficulties encountered in road building on the Balch project.

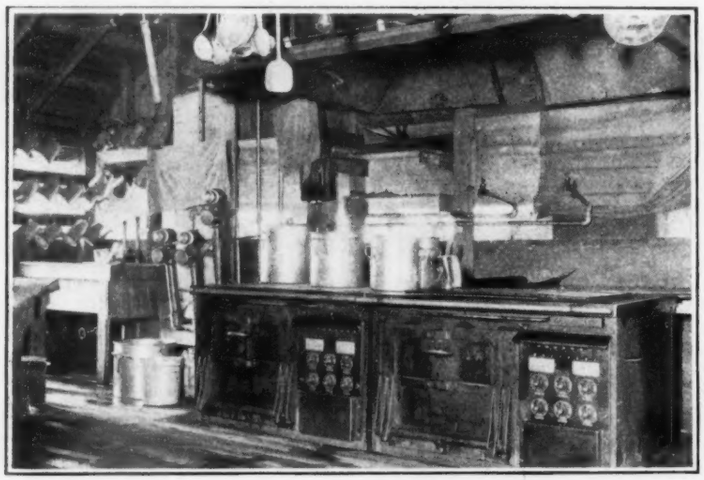
POWER SUPPLY

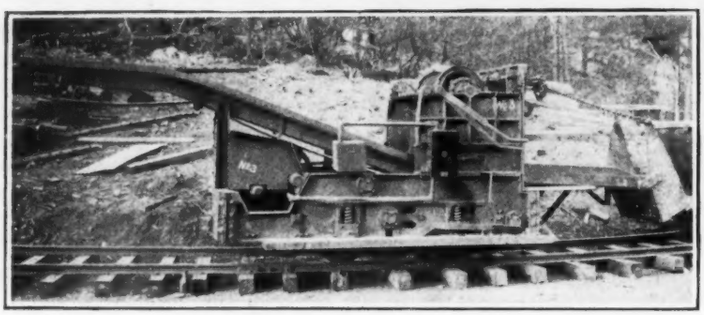
An adequate and dependable electric power supply is absolutely indispensable in the execution of a job of this nature if modern construction methods are to be used to keep down costs. Since a transmission line would be required in any event to deliver the output of the plant into the company's transmission system, it was decided to build the permanent line to the power-house site, there to step down to a lower voltage for distribution to points of power requirement on the job. The permanent 110-kv. steel tower line was built when power was first needed for tunnel operations and an outdoor substation of 2,250-kva. capacity was installed near the power house. During the construction period the line is operated at 60 kv., and this voltage is stepped down to 11,000 volts for distribution over the job. Consideration was given to building a temporary line to save fixed charges on the permanent line during the period of plant construction, but it was quickly seen

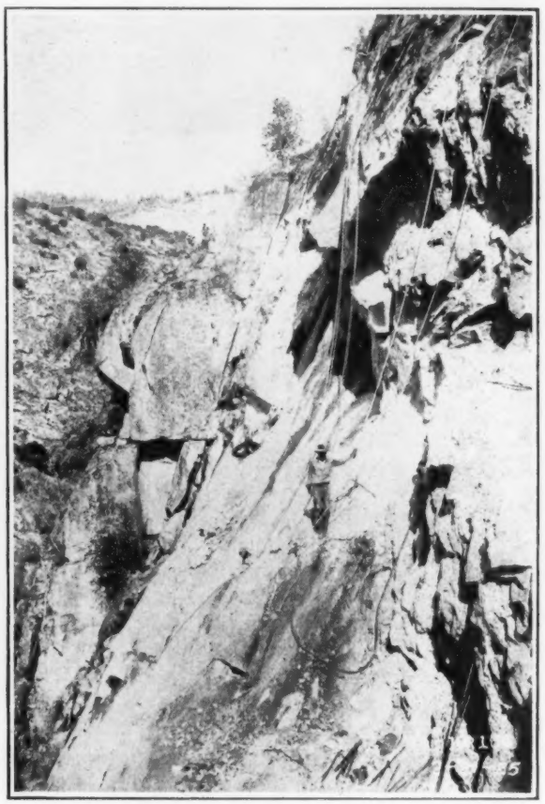
that the temporary line would be the more expensive. The steel tower line was built for approximately $8,500 per mile and, at 10 per cent, fixed charges amount to $850 per year, or, for the two years the line is up in advance of what otherwise would have been necessary, accrued fixed charges will total $1,700. A temporary wood pole line would cost approximately $3,500 per mile and at the end of the construction period the cost of removing the material would have equaled the salvage value. Therefore erection of the permanent line effected a saving of $1,800 per mile.

There is a connected load of 5,000 hp. in electrical equipment on the job. Some of this equipment is entirely new on a construction job of this character and weather conditions, accidents or unforeseen circumstances, and the exigencies of the case may require a modification of plans, but the effort is made to keep the sequence of operations such that the minimum amount of equipment is required. Progress charts are kept for every major operation, showing the exact status of the work, and from these it can easily be ascertained whether crews are behind or ahead of schedule and how the job as a whole is progressing.

The work on the Balch job is departmentalized under six heads working on a parity and each reporting to the superintendent of construction. Each has certain well-defined duties and operations under his direction and each man is directly responsible to the construc-







ELECTRIC CAMP KITCHEN, TUNNEL MUCKER AND CLIFF ROAD UNDER CONSTRUCTION

Top, left—Cooking costs in construction camps have been cut in half by heavy-duty electric ranges on the Balch development. Bottom, left—Electric tunnel mucker driven by 40-hp. motor through system of clutches. At right—Cutting a motor trucking road out of a solid granite cliff.

will be discussed later. Three-phase, 60-cycle, 440-volt power is standard for all motors, whereas lighting and heating are supplied at 110/220 volts single phase.

An average of 500 men are employed at present, and it is rather interesting to note that there is 10 hp. of connected electrical equipment and 4 kw. of demand for every man employed on the job. During the past summer while construction has been in full swing the average monthly consumption for all purposes has been 435,000 kw.-hr., which is billed against the job at full tariff rates. The total bill for power on the job will probably amount to 1.5 per cent of the total cost of the development.

On the Balch development the entire job was planned in advance and each component part was scheduled to be started and completed on certain definite dates. This schedule, of course, sometimes is disrupted by adverse tion superintendent for matters coming under his jurisdiction. The departments are co-ordinated by holding periodic meetings, at which all phases of the work are discussed and decisions made. These meetings not only familiarize everybody concerned with all plans for the future but also make it possible to utilize the combined experience and judgment of each man.

Some time previous to the time actual work began on the project careful consideration was given to the possibility of improving the accounting and cost-keeping procedure as practiced on former jobs, principally with the purpose of simplifying it without sacrificing necessary records. In other words, it was attempted to eliminate all unnecessary red tape and to set up a system that would in no way slow up the construction work proper, this being especially true in the distribution of materials. The number of accounts in the accounting

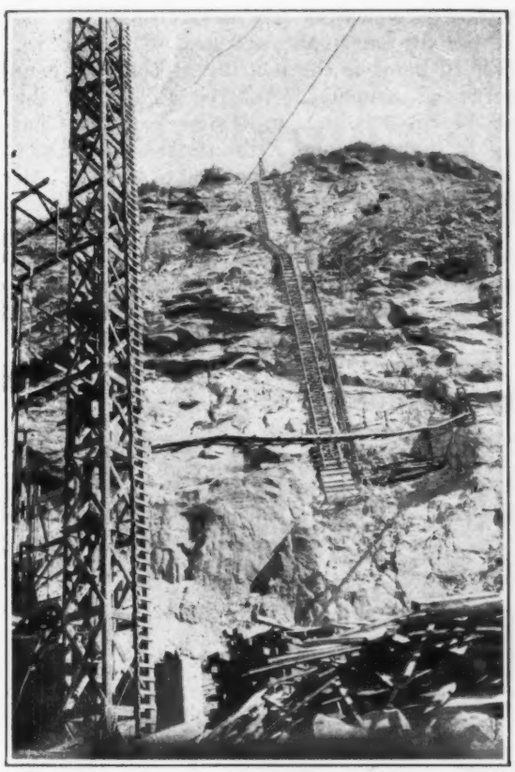
schedule has been reduced and materials are charged direct to the point of consumption or point of use wherever possible, instead of being carried in stock. The material ledgers are carried in an office adjacent to the workhouse, thus allowing them to be used by both the superintendent of supplies and the chief accountant. Several jobs which are sometimes considered sufficient for one man have been combined with a saving of several men. Outside of the timekeeper in each camp, the chief accountant is handling with seven men a job involving the expenditure of $5,000,000.

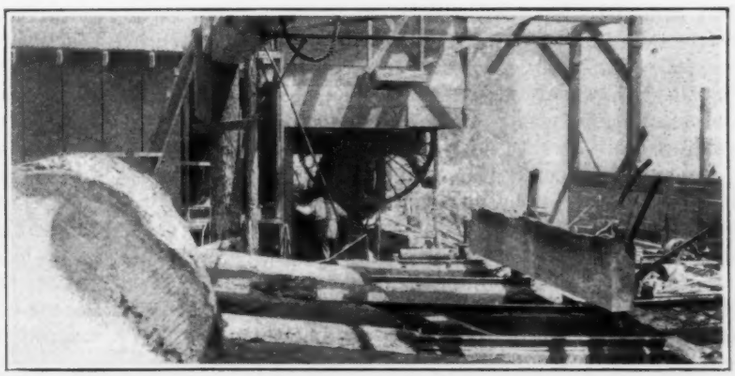
Inasmuch as an accountant cannot be expected to give costs that are approximate and is not in a position to give any costs at all except once a month when his books are balanced, a cost statistician is employed. The purpose is twofold: first, he prepares immediate unit costs to be used by the superintendent of construction for control of the work, and second, he prepares re-estimates, reports, etc.

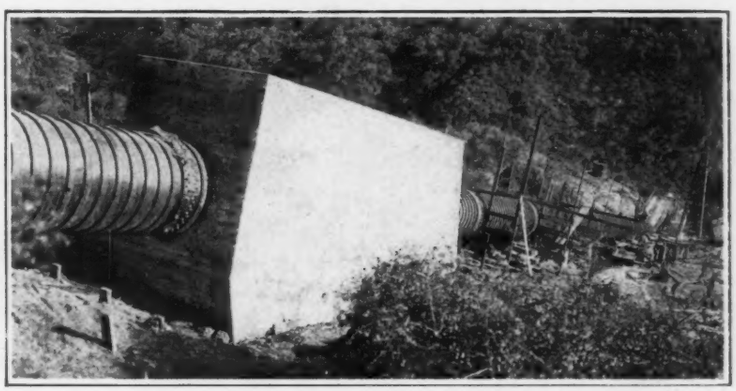
The secret of low labor turnover, in the opinion of men connected with this job, is in providing good food and clean and comfortable housing for the men. Cooks are carefully selected for their cleanliness and ability, and at each camp they have been provided with hotel type electric ranges, which have proved very successful both for economy and quality of cooking. The greater comfort in working around these electric ranges has materially reduced labor turnover in kitchen help, and all the cooks in the six camps are enthusiastic boosters for electric cooking. Hot water for the kitchens is provided by two thermostatically controlled 5-kw. water heaters operating on 200-gal. lagged tanks. Water is heated for the shower baths in the bathhouses by one 5-kw. automatic heater connected with two 200-gal. tanks. In both cases 24-hour hot water service is given. Wash trays are provided where the men may wash their own clothes if they do not care to avail themselves of the camp laundry service. At three of the six camps are to be found many desirable locations for tent-houses, where some of the engineers, foremen and skilled workmen keep their families. These facilities, together with a school, library and the radio, have done much to keep the men and their families contented.

As brought out earlier in this article, the construction engineer is continually battling with costs and he must constantly use every bit of ingenuity and good judgment he possesses to select equipment and devise methods that will save time or labor or do a better and cheaper job. The greatest field in which to improve over older methods is probably in the use of electrical equipment, and on the Balch development there are several pieces of electrical equipment entirely new to construction jobs so far as is known.

One such piece of equipment that is entirely new is an electric furnace for heating and tempering rock drills. This furnace has a capacity of 50 kw. and is equipped with Globar elements that will stand temperatures up to 2,500 deg. F. The desired temperature, usually about 2,300 deg., is maintained automatically by means of thermostatic control. Six minutes is required to bring the drills up to working temperature and with a capacity of fourteen drills it is possible to maintain a continuous flow of drills through the furnace at the rate of two a minute. The cost for current is approximately







CONCRETE CHUTE, ELECTRIC SAWMILL AND PENSTOCK UNDER CONSTRUCTION

At left—Shooting concrete down a 700-ft. vertical drop by compressed air through a 6-in. pipe. Top, right—Electrically operated sawmill where lumber for camp buildings, forms, etc., was produced on the job. Bottom, right—Laying a 56-in. banded steel penstock. The concrete block is one of the several anchors installed along the 4,882-ft. penstock.

$4.50 per day and maintenance amounts to about $1 per day, making the total operating cost $5.50 per day, which is about the same as for oil fuel and the maintenance of an oil furnace. The electric furnace, however, has the advantages of giving a more uniform product, better temperature control, less breakage and less noise and discomfort to the workmen. The tunnel foreman is well satisfied with the furnace and plans to use similar equipment on future work.

Another piece of electrical apparatus that is somewhat new on construction work is an electric welding outfit. Electric welding on this job has reduced welding costs to one-third of the cost of gas welding and furthermore many jobs can be done by electric welding that cannot be done with acetylene, such, for instance, as the welding of parts on the under side of a truck chassis. The acetylene torch has not been completely displaced, however, as it is indispensable for cutting and special jobs where the work cannot be taken to the welding outfit.

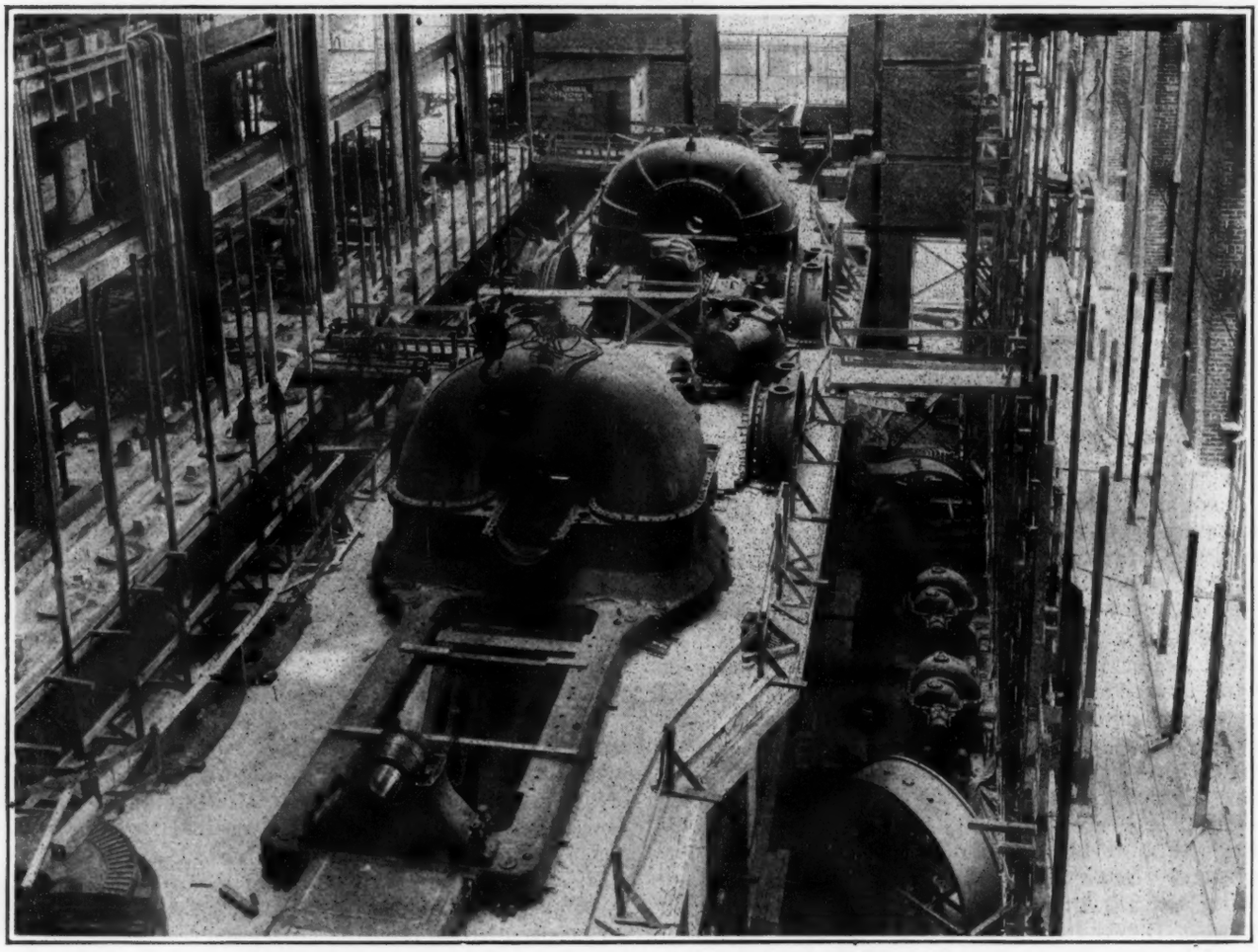
Heavy-duty electric ranges in the six camps have reduced cooking costs by one-half as against oil, the nearest competitor, whereas wood would cost two and one-half times what electricity is costing. In a camp feeding 100 men the average monthly consumption for two 22-kw. ranges and two 5-kw. water heaters is 12,500 kw.-hr. per month. Approximately one-third of this consumption is for water heating. Electric cooking costs on the job amount to about one cent per meal, at a cent per kilowatt-hour. All bread baking for the six camps, feeding an average of 500 men, is done in a central bakery in a 20-kw. electric bake oven, and the bread is distributed to the various camps by truck.

Hogs kept on the job dispose of the garbage and furnish the requirements for pork for all camps. Refrigerating plants of one-ton capacity at two of the camps provide refrigeration for meats and ice for preserving foods at the other camps not so equipped.

CONCRETE WORK

Where there is concrete work scattered over a wide area as on a hydro-electric job, careful planning is necessary, especially on small yardages, to keep down costs. A case in point is the pouring of concrete penstock anchors and supports. On the Balch job the penstock will be 4,882 ft. long on a slope ranging from about 15 deg. at the upper end of the penstock to almost a vertical drop of 700 ft. at the power-house end. An incline railway was built along the penstock line for all excepting this last 700 ft. The method of concreting was to connect two incline cars together, with the mixer mounted on the lower car and bins for the aggregate and cement on the upper car. Thus the ingredients for the concrete flowed down through a chute by gravity into

Installation of Turbines at Edgar Station



View of the turbine room of the Edgar station of the Edison Electric Illuminating Company of Boston during construction. Main units and auxiliaries are installed by an overhead crane.

the hopper of the mixer and from the mixer into another chute and on down by gravity into the forms. Water was supplied from a pipe line paralleling the inclined railway. This scheme greatly facilitated the work and reduced the costs over other methods. On the steepest section of the penstock concrete piers and anchors were poured from a mixing plant installed at the top of the bluff.

This plant at the top of the bluff was made of sufficient capacity to handle all concreting in and around the power house. The pure granite tunnel muck is hauled down the inclined railway from the tunnel portal to a rock-crushing plant located just above the concrete mixer. The granite is crushed, screened and graded and stored in bins, from which aggregate and cement flow by gravity down into the mixer. From the mixer the concrete is conveyed down the 700-ft. practically vertical drop to the power house by a unique and entirely new method. The mixer discharges into an air-tight hopper, which when filled is closed and compressed air under about 30 lb. pressure is admitted to force the concrete down through a 6-in. flanged iron pipe into a metal-pouring chute at the lower end. When this method was first proposed, it was thought that the concrete would string out in the pipe and allow the air to pass through without carrying the concrete along with it, but this did not prove to be the case and several thousand yards of concrete has already been successfully poured at a large saving over estimated costs had the plant been located at the power house proper.

Step-Induction Regulator-Controlled Synchronous Converters

Automatic Operation and Absence of Usual Starting Apparatus Are Features of This Type of Converter Control — Permit the Most Effective Utilization of Equipment in Emergencies

By M. F. PACKARD
Westinghouse Electric & Manufacturing Company

THE modern Edison distribution system, as it exists in most of our large cities, has developed naturally from what may be considered the predecessor of the present-day central station. Electric service to fairly extensive areas of relatively low load density was first supplied by the direct-current three-wire system from steam stations equipped with engine-driven generators either belted or direct connected. The development of the alternating-current system and the highly efficient steam turbine caused the replacement of the Edison generators with apparatus for converting alternating current to direct current. Under such conditions it soon became economically out of the question to operate the isolated direct-current plants, and gradually the service rendered by them was taken over by the Edison systems.

Automatic Operation Minimizes Need of Storage Batteries

The importance of the load in the districts served by the modern Edison systems and the resulting low-resistance networks that have come into existence through the increase in load density present a problem of service maintenance found in no other class of electric service. Most large Edison systems have built up large storage-battery reserves to assist in times of trouble or power failure.

The development of the synchronous booster converter offered savings in cost, space and losses over other types of conversion equipment then available, along with voltage control through a range sufficient for normal operation. These advantages were responsible for its extensive adoption in Edison service. Its limitations in the way of voltage control were such that the reserve battery still remained practically a necessity during severe disturances and for service restoration. Even where motor-generators were retained as the main conversion apparatus, the reserve battery was needed for service restoration purposes. Complete automatic operation or a near approach to that condition already exists on a number of systems and their reserve batteries either have been eliminated or allowed to deteriorate with ultimate scrapping in view.

Desirable Features of Control Retainable with Motor-Generators

The synchronous motor-generator under automatic control lends itself most satisfactorily to the requirements of Edison service. This may seem like a step backward, but the superior operating characteristics, combined with the flexibility of control, which insures the equipment remaining on or being reconnected to the line under the most adverse circumstances, offsets the higher efficiency of the booster converter. Nevertheless all the desirable characteristics in system control may be retained economically, without the exclusive use of motor-generators, through the medium of the simple shunt-wound converter with step induction type voltage regulator. On most Edison systems the installation of approximately one-half the substation capacity in the form of automatically controlled motor-generators would be adequate to provide satisfactory voltage control during service restoration or extremely severe direct-current disturbances. This allows sufficient margin for units out of commission and makes it possible to install the type of converter equipment just described to supply the additional capacity requirements.

The ideal layout of substations would be such that a converter and motor-generator of approximately equal capacity could be installed in each. It is entirely prac-

ticable to operate the two types of equipment on the same direct-current bus under automatic voltage regulator control, the converter ordinarily being arranged for three-wire service and the motor-generator for two-wire. Maximum economy is obtained in this way for the reason that the converter always takes precedence while the voltage remains within its operating range and the motor-generator is called upon only when its added capacity is needed to supply the load or the voltage is too low for the converter. During light-load periods, which aggregate a large percentage of the time, the efficient converter outfit operates by itself with a

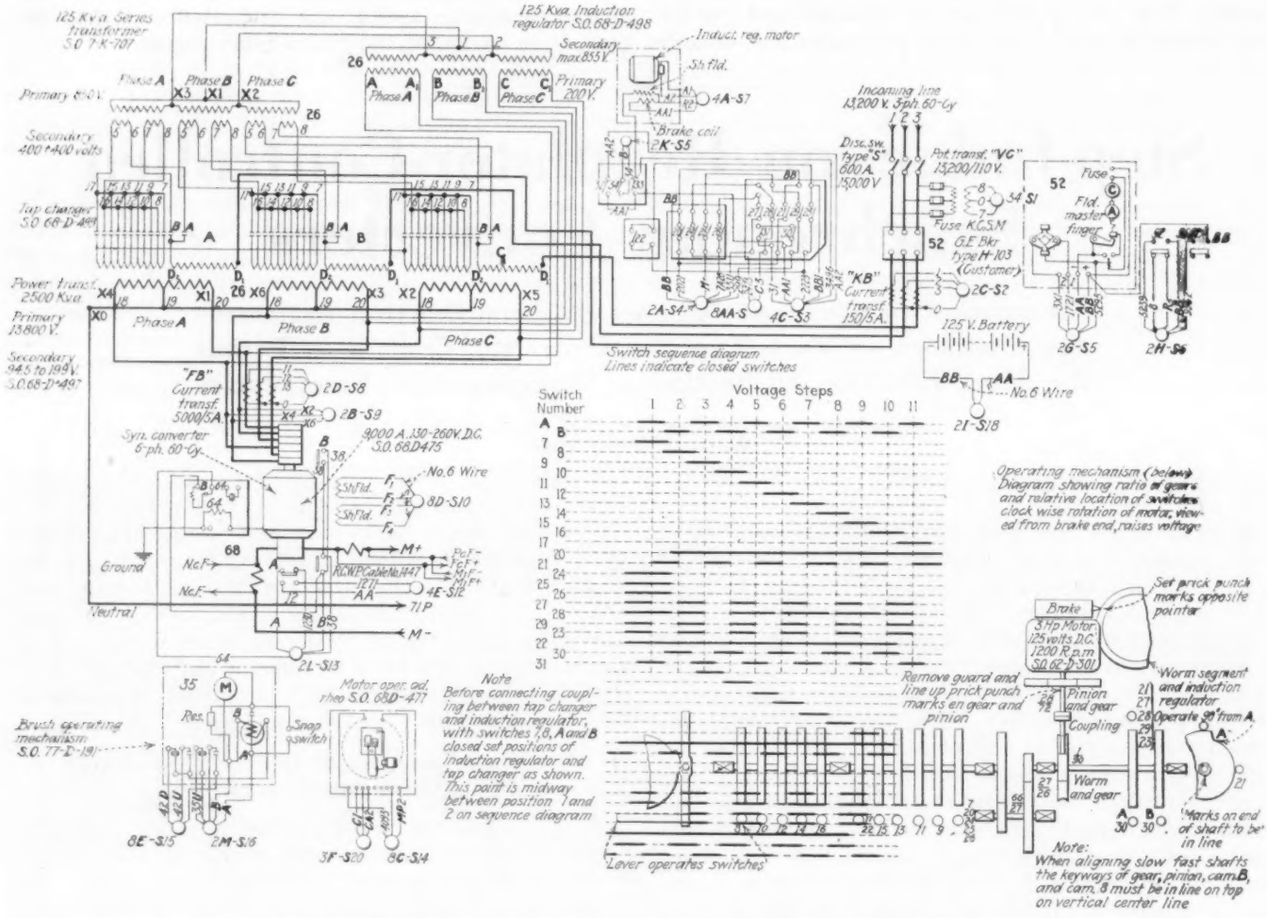

125 Kv.a. Series transformer S.O. 7-K-707
125 Kva. Induction regulator S.O. 68-D-498
Induct. reg. motor
Sh. fld.
Brake coil
4A-S7
2K-S5
Incoming line 13,200 V. 3-ph. 60-Cy.
Disc. Sw. type "S" 600 A. 15,000 V
Pot. transf. "VC" 13,200/110 V.
Fuse K.C.S.M.
G.E. Bkr. Type H-103 (Customer)
"KB" Current transf. 150/5 A.
2C-S2
Fuse
Fld. master
54 S1
52
2A-S4
8AA-S
4C-S3
125 V. Battery
2G-S5
2H-S6
Primary 6600 V.
Secondary 400+400 volts
Tap changer S.O. 68-D-469
Power transf. 2500 Kva.
Primary 13,800 V.
Secondary 945 to 1995 V. S.O. 68-D-497
Phase A
Phase B
Phase C
Switch sequence diagram. Lines indicate closed switches
No. 6 Wire
"FB" Current transf. 5000/5 A.
2D-S8
2B-S9
Syn. converter 6-ph. 60-Cy.
9000 A. 130-260 V. D.C. S.O. 68-D-475
8D-S10
Sh. Fld.
Ground
Neutral
Nc.F-
M+
M-
4E-S12
7 I.P
2L-S13
Switch Number
Voltage Steps
Operating mechanism (below) Diagram showing ratio of gears and relative location of switches. clock wise rotation of motor, viewed from brake end, raises voltage
Brake
3 Hp Motor 125 volts D.C. 1200 R.p.m. S.O. 62-D-301
Set prick punch marks opposite pointer
Worm segment and induction regulator
Operate 29° from A
Pinion and gear
Coupling
Worm and gear
Marks on end of shaft to be in line
Remove guard and line up prick punch marks on gear and pinion
Lever operates switches
Note: When aligning slow, fast shafts the keyways of gear, pinion, cam B, and cam 8 must be in line on top on vertical center line
Note Before connecting coupling between tap changer and induction regulator, with switches 7, 8, A and B closed set positions of induction regulator and tap changer as shown. This point is midway between position 1 and 2 on sequence diagram
Brush operating mechanism S.O. 77-D-191
Motor oper. ad. rheo S.O. 68-D-477
Snap switch
8E-S15
2M-S16
3F-S20
8C-S14

FIG. 1—DIAGRAM OF CONNECTIONS OF STEP-INDUCTION REGULATOR

material saving in substation losses as a result. Equipment of this type is now being successfully operated by the Union Electric Light & Power Company of St. Louis. Two substations, each containing a 9,000-amp. converter and a 7,500-amp. motor-generator, have been in service for some time and recently a third station with similar equipment has been put in operation.

The equipment comprising each of these step-induction regulator-controlled converter installations consists of a three-phase main transformer, a three-phase induction regulator with associated series transformer, all oil-insulated, self-cooled; an oil-insulated selector and transfer switch unit, and the necessary control apparatus. The main transformer is provided with the usual secondary winding for normal converter voltage and connected six phase diametrical with the neutral brought out for three-wire direct-current service. The primary windings are connected in star and each phase is wound in two sections having the same number of turns. One of these sections is provided with equally spaced taps suitably connected to the selector switches so that a portion or the whole may be connected in series with the other section, thus varying the primary turns and permitting a variation of secondary voltage from normal down to 50 per cent. The selector and transfer switch unit is mechanically connected to the induction regulator, both being operated by a direct-current motor mounted on the latter. The series transformer performs the double function of insulating the induction regulator secondary from the high-voltage main transformer winding and providing two secondary windings, which permits change from buck to boost by reversal of one winding through the transfer switch action.

Functioning of Regulator Control for Converter Installation

The diagram, Fig. 1, shows the connections of the equipment. It may be seen from the switch sequence portion of the diagram that in position 1, transfer switches *A* and selector switches 7 are closed. At the limit of travel the induction regulator voltage, applied through the series transformer, is added in such phase relation to the line voltage that the resultant has the same value as the line voltage. Minimum voltage is applied to the converter slip rings in this position. A gradual increase in voltage results as the induction regulator voltage is brought more and more nearly into

phase with the line voltage when the rotor is turned by the driving motor. With the two voltages exactly in phase the induction regulator component is equal to one-half the voltage between adjacent transformer taps. Transfer switches *B* and selector switches 8 close when this condition is reached, whereas switches *A* and 7 open slightly later. Connection is thus completed to the next transformer tap through the other winding of the series transformer, which supplies a voltage in exact phase opposition to the line voltage, so that no change in the converter voltage results. Continued operation of the induction regulator reduces its effect upon the line voltage till the full value of the latter is applied to the tap, the converter voltage increasing uniformly. This completes one cycle, which is repeated for each transformer tap and the converter voltage raised to the maximum. The two secondary windings of the series transformer are in series during the transition periods, but the short-circuit current will be very small, since their voltage is approximately equal and opposed to the voltage induced between transformer taps. The control equipment of the driving motor is provided with a holding circuit, effective during the transition periods only, to insure against coming to rest at these exact points.

Where Converter Fits Into Motor-Generator Installation

In the automatic operation of this type of equipment with a synchronous motor-generator on the same direct-current bus, the synchronous converter is the preferred unit within its voltage range so that it will start upon load demand and operate under the control of a voltage regulator which functions on the motor of the step-induction regulator. It may continue to operate in this way until the load increases to the point where the motor-generator goes on the bus. As soon as the latter is started the voltage-regulating element of the first unit is recalibrated to regulate for a slightly higher voltage, which insures that the current-regulating element will take control. Simultaneously the current-regulating element of the first unit is recalibrated to regulate for a current somewhat less than full load, which insures that the incoming unit will have a certain amount of load transferred to it, thus preventing shutdown through the functioning of the underload relay, should the total load not increase immediately much beyond the capacity of the first unit. Under these conditions the voltage-regulating element of the second unit controls the bus voltage and any increase of load is carried by this machine. As soon as the load rises to a value such that there will be no danger of underload shutdown, the original calibration of the current-regulating element of the first unit is restored and it will assume its full capacity load. The second unit will then handle any increase in load up to its rating, at which point control is taken over by its current-regulating element. With decreasing load the operations are reversed and no sudden dropping of load takes place when the second unit shuts down.

Excessive overloads are rapidly reduced in the case of the motor-generator by the current regulator operating on the high-speed generator field rheostat. The generator is separately excited, thus permitting rapid variation in its voltage from zero to a maximum by this control. Changes in converter voltage necessarily take place at a rate considerably less than in the case of the generator because of the slower action of the step-induction regulator. By means of direct-current overload relays which operate to insert current-limiting resistors quickly, the load on the converter is reduced more rapidly than would be possible through action of the current regulator on the step-induction regulator motor. At the same time connections are established to permit the step-induction regulator to reduce the converter voltage so that the resistors may be short circuited again at the earliest possible moment. Inverse time element overload relays in the converter alternating-current leads cause shutdown if an excessive overload persists for any reason. Shutdown will also take place through the functioning of protective thermostats should the resistors, which are of limited capacity, remain in the circuit for a sufficient length of time to overheat.

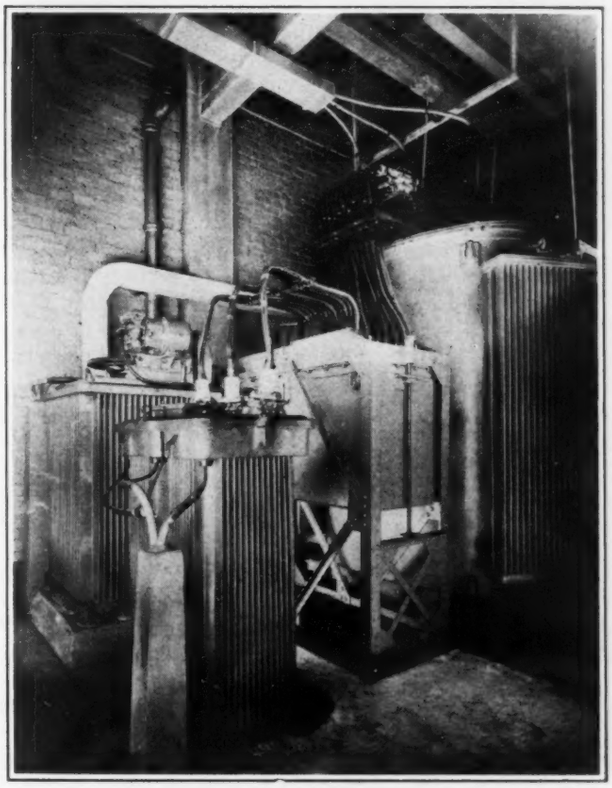


FIG. 2—REAR OF CONVERTER TRANSFORMER

Showing transfer and selector switch unit and induction regulator with associated series transformer.

A unique feature of the step-induction regulator-controlled converter is found in the absence of the usual starting apparatus. Converters of large capacity are commonly started by the star-delta method; the cost and complication of the starting breakers are avoided by the step-induction regulator, which automatically assumes the minimum voltage position whenever the converter is shut down.

The field for this equipment is not limited to automatic service. For manual operation it provides everything obtainable by the use of the booster converter, along with superior performance and a voltage range that makes it of real assistance in bringing up a dead system or in the maintenance of service under adverse conditions.

Utility Courses Inaugurated at Northwestern and Illinois

Those Offered Include Studies of Economic, Financial, Legal and Managerial Principles of Public Utility Regulation and Control

AT LEAST two universities in this country have recognized the increasing importance of public utilities and have provided special public utility courses. They are Northwestern University and the University of Illinois. Public utility executives of Illinois have been asked by the Illinois Committee on Co-operation with Educational Institutions to disseminate information regarding the utility courses of these two universities among their acquaintances, particularly high school principals and young men already in college.

Northwestern University has inaugurated a special group of afternoon and evening courses emphasizing the economic, financial, legal and managerial principles underlying effective operation and management and the problems arising out of public regulation and control. The courses are intended for persons who desire to enter the service of public utilities as well as those now employed by or associated with public utilities.

In announcing this new course Northwestern University School of Commerce says: "In almost every aspect—accounting, financing, law, operation and management—the activities of public service industries differ greatly from those of private business. The scope of government control of the utility business is much broader than private business. Policies of management are determined to a great extent by the character of public relations and public control. For these reasons it is believed that the most effective approach can be provided through a group of special courses."

The University of Illinois, in describing the facilities it offers through its College of Commerce and Business Administration, points out that it "offers its students a knowledge of the fundamental economic principles underlying the public utility business. No attempt is made to train students for particular positions in the utility field; specilization is not carried that far. The academic staff is assisted by a number of leading utility executives who come regularly to the campus to lecture."

The nature of some of the utility courses which are being offered at these two universities are briefly described below:

NORTHWESTERN UNIVERSITY

Fundamentals of Public Utility Accounting.—Primarily for the employees of public utility corporations. Includes form and use of records, simple financial statements, typical accounts and inventories.

Economics of Public Service Industries.—Introduction to entire curriculum, including what constitutes a public utility, the public service industry of the United States, production of utility services, public utility revenues, capitalization, monopoly and competition, economic basis for regulation and ownership of public utilities.

Regulation.—Includes the basis of public utility regulation, its development, critical analysis and comparison of various methods, valuation and rate base, rate of return, and regulation of service and security issues.

Operation.—Aims to acquaint the student with the technical developments of public utility industries, operating organization and control.

Accounting Procedure.—A description of records and procedure peculiar to utilities.

Principles of Utility Accounting.—Continuation of fundamentals of accounting. Includes accounts peculiar to public utilities and corporations, development of accounting records and financial statements.

Utility Law.—Legal characteristics of public utilities, kinds of utilities, corporate organization, duties, regulation of rates, peculiar rights and powers.

Administration. — Problem approaches emphasized, the case method of study being used so far as practical.

Finance.—A critical study of the financial organization, operation, government control, public utility securities and markets and analysis of utility financial reports.

Problems in Accounting. — Comparisons are made with industrial practice, covering classification of accounts, financial reports and purchase or sale of utility properties.

Principles of Utility Economics. — Emphasis placed on technical economic problems.

Principles of Regulation. — Intensive study of problems from private and public points of view.

Rates and Ratemaking.—Analysis of problems from viewpoint of the management and regulatory body.

Labor Policies. — Deals with problems of employment, training, and promotion, systems of payment, efficiency, welfare services, discipline, adjustment of disputes, etc.

Seminar.—Serves as a means of administering and coordinating the advanced research studies being conducted in the utility field.

UNIVERSITY OF ILLINOIS

Principles of Utilities.—Covers history, economic peculiarities, relationship to the community and each other, valuation and rates, service and financial requirements, customer ownership and public relations, and regulation.

Operation.—Study of economic problems connected with production, distribution and service, organization of departments, their relation to each other and to the customer.

Management.—The organization of utilities and the functions and relationships existing among their various departments are examined and a careful survey made of methods of handling the more prominent problems, such as promotion and finance, capital turnover, consolidations, receiverships and reorganizations, customer ownership and public relations, expansion of business, accounting, publicity, complaints, relation to regulatory commissions.

Regulation. — Specific knowledge particularly on those phases that are of unusual importance to the utility executive. Detailed study of selected cases, commission orders and decisions and court decisions.

Administration. — Deals with the broader managerial problems, particularly organization, finance, consolidations, customer ownership, public relations.

Seminar.—Graduate students and faculty members discuss weekly economic problems of special interest, books and journals being reviewed, criticised and discussed.

Hydro-Electric Progress in Spain

DURING the last financial year the plant at the power stations of the Sociedad Hidroelectrica Española was increased by the addition of six 6,250-kva. monophase 132,000/66,000/6,000-volt transformers, bringing up the total transformer capacity to 37,500 kva., without taking into consideration the 13,500-kva. plant which has been in use since 1910 and which is being removed to the Villora station to step up the current from a new 15,000-kw. turbine and generator set. A new transmission line has been completed between Olmedilla (Cuenca province) and Madrid, a distance of about 100 miles, and it is hoped to increase the tension on the line this year to 132,000 volts to supply Madrid with an additional 24,000 kw. At the Olmedilla transformer station three new 10,000-kva., 66,000/132,000-volt monophase transformers are being installed to receive current from the Villora and Molinai stations and for its transmission to Madrid. The new work which is about to be taken in hand includes a hydro-electric station to utilize the second portion of the Dos Aguas falls and to have an output of 250,000,000 kw.-hr. per year.

Rochester Utility Building Has Many Automatic Devices

By KATHRYN L. SHATTUCK

Features Include Unique Water Curtain for Fire Protection, Automatic Visual Elevator Signals, and Heating-Ventilating Systems

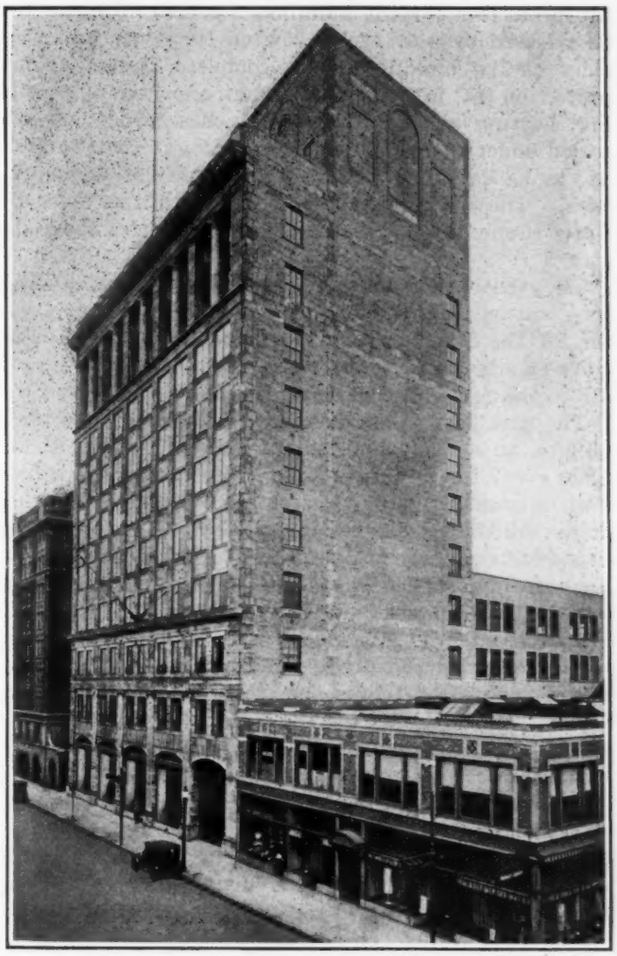
THE new Rochester Gas & Electric Building, which has been recently opened to the public, is completely equipped with every possible automatic time and labor-saving device. Perhaps the elevator system has the most markedly interesting set of efficiency regulators.

The complete elevator installation will consist of three cars having a capacity of 2,500 lb. each and a fourth car with a capacity of 4,000 lb. The cars are run on a schedule that provides for an elevator leaving the main floor about every minute and a half. Automatic signal lights in each car tell the operator when to start on a trip. In this manner cars can be started for certain floors at fixed times and pick up loads on these floors on an alternating time-saving system.

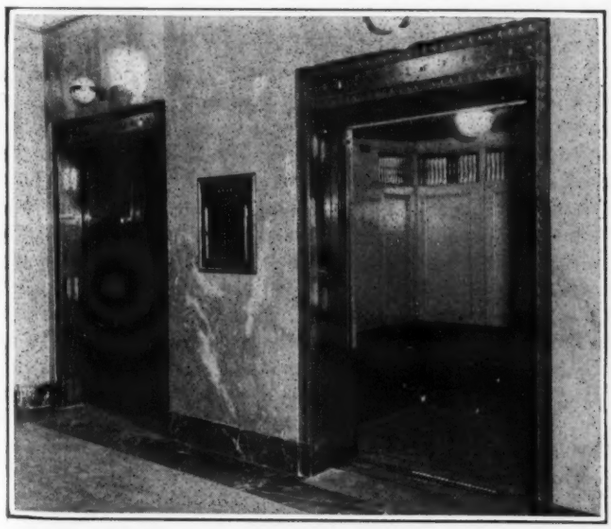
An entirely new feature for elevators in Rochester is the horizontal row of automatic signal lights above each hatchway door on the ground level. These lamps, set in a heavy bronze frame above the entrance, automatically light as the cars pass the various floors.

Other features of the automatic system in the building include a master clock in the basement, which sets each clock in the building minute by minute throughout the day. The vacuum-cleaning system which extends to every floor is controlled from a single small turbine in the engineering part of the basement. An automatic refrigerating system supplies cold drinking water to every department and also maintains a supply tank completely filled.

If an emergency should arise demanding immediate

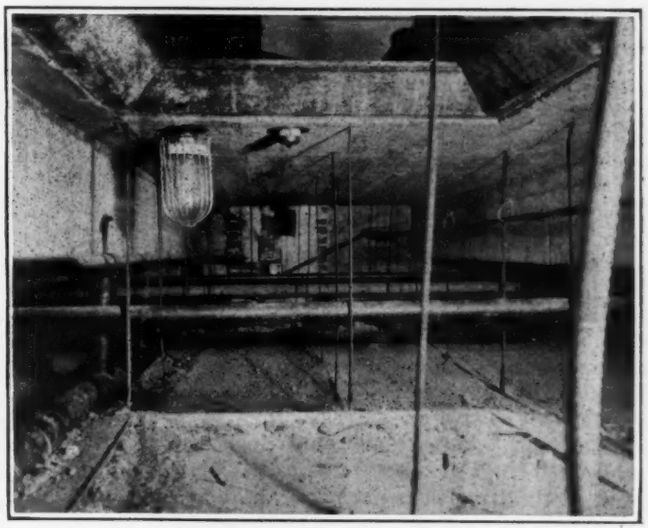


NEW BUILDING OF ROCHESTER GAS & ELECTRIC COMPANY



AUTOMATIC ELEVATOR SIGNALS

An entirely new feature for elevators in Rochester is the horizontal row of automatic signal lights above each hatchway door at the ground level. These lamps, automatically light as the cars pass the various floors showing in numerals the exact location of the car.



A VIEW BETWEEN FLOORS

A space three feet high between every floor and ceiling in the Rochester Gas & Electric building carries the plumbing, heating, and ventilating systems to the various departments. The parallel rows of steel rods support the framework for the hung ceiling.

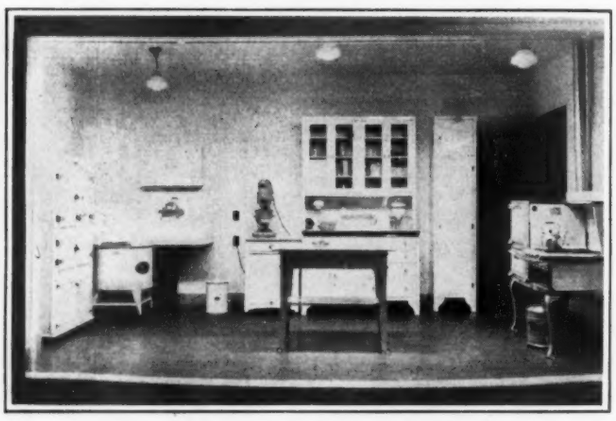
fire protection for the building, a screen of water can be released over every window on the south and west sides of the building. This complete system of fire protection ties in with the automatic sprinklers, plumbing, heating and ventilating branches, which lie concealed under every floor in the building. The two storage tanks for this system have a capacity of 10,000 gal. each. These two tanks, together with the domestic water supply tank, are located thirteen stories above the street.

The ventilating units in the building are divided into two separate sections, one of which supplies fresh air for the first floor and basement; the other, located thirteen stories above the street, distributes the filtered air to the remaining parts of the building.

The first floor is supplied with 24,000 cu.ft. of air a minute, an amount sufficient to change its cubical contents every ten minutes. This air is heated for winter use; in summer the unit serves for ventilation purposes only. All of the air passing through this ventilating unit is filtered through a series of steel-incased filters. Each casing is filled with steel shavings covered with oil. In this manner the air is partly purified and kept practically clean. The second unit, in the pent house, thirteen stories above the street, supplies air to ventilate portions of the second, third and fourth floors. The filtration process for the upper floors is the same as that in the basement. The capacity for each floor is 4,000 cu.ft. per minute.

Semi-indirect lighting is the system of general illumination that is carried throughout the building. On every floor except the main floor a 300-watt light is spaced approximately 10 ft. from the next one, giving an average of 2¼ watts for every square foot of floor.

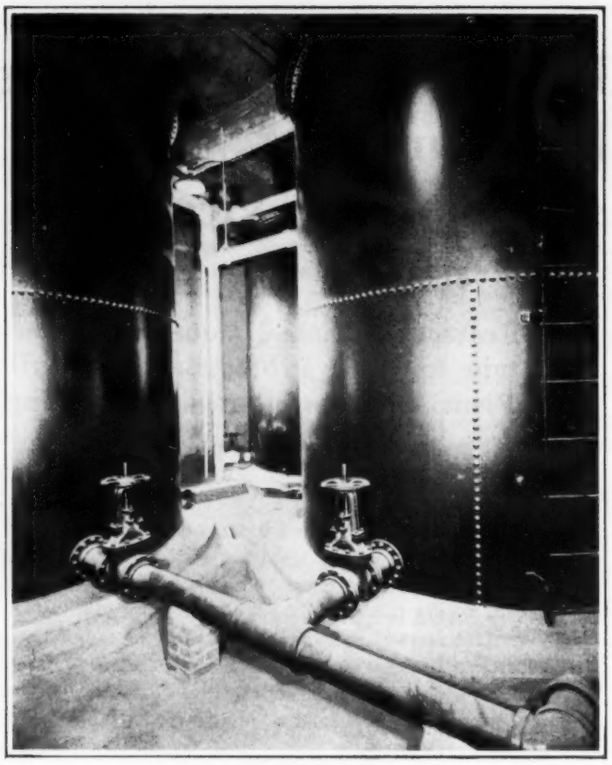
All of the hung ceilings are illuminated with light and plug receptacles spaced approximately 15 ft. apart. Access to these features between the floor and ceiling below is through manholes which are placed in each bay across the building. Enough utility space below



THE MODEL ELECTRIC KITCHEN

every floor allows all electrical lines of communication, dictograph, telautograph and telephone wires, Postal and Western Union service and the plumbing, heating and ventilating lines for the building to be readily accessible and yet concealed from view.

The heating of the building is accomplished by direct radiation on thermostatic control with steam supplied to a two-pipe vacuum system from the Lawn Street station. All of the ventilating units are supplied with



WATER STORAGE FACILITIES

These two tanks together with the domestic supply tank are located in the pent house thirteen stories above the street and are to work in conjunction with the 750-gal. centrifugal motor-driven fire pump, which acts as a secondary source of supply.

steam and have regulating valves operated from thermostats which are placed in discharge ducts so that the steam will be regulated automatically to maintain a uniform temperature throughout the ducts.

A unique feature connected with this building is the installation of a heat chamber beneath the sidewalks running along the sides of the building. The coils heat the chamber to a temperature required for melting snow and the ice on the walk in the winter.

New Hydro-Electric Stations in Italy

A NEW hydro-electric power station has recently been completed at Ponte Fiume on the Lower Liri River in central Italy. A head of about 52 ft. has been obtained by constructing a dam 40 ft. high across the river. The plant at the station comprises two 4,500-kva. turbines coupled to Siemens generators and one 2,250-kva. set. The current is generated at 12,650 volts, at which pressure it is transmitted to the transformer station at Ceprano, where there are installed two 2,000-kva. transformers which step up the current to 30,000 volts, two 10,000-kva. sets giving 65,000 volts on the secondary side and two 3,000-kva. sets stepping up to 20,000 volts. Work is also in hand on the construction of a second station, at Ceprano, to utilize the power of the same river. In this case the water is to be led by a canal about 13 ft. in width and nearly 2½ miles in length to a storage lake. The station is being designed to accommodate three sets of 5,600-hp. turbines and generators, of which, however, only two will be at first installed. With a head of about 164 ft. and a water supply of about 5,000 gal. per second, it is expected that an annual output of 50,000,000 kw.-hr. will be attained.

Requirements of Oil Switch Operating Mechanisms

High Speed of Break, Minimum Power Input and Low Cost Are Important Factors—Stored Mechanical Energy Device Is Described

By ROY WILKINS

Assistant Engineer Division of Hydro-Electric and Transmission Engineering, Pacific Gas & Electric Company, San Francisco, Cal.

BY FAR the most important single piece of equipment in present-day high-tension transmission systems is the circuit-interrupting apparatus. For this reason the attention of engineers has been focused on the oil circuit breaker during the past few years and manufacturers have spent a great deal of time in an effort to keep pace in oil circuit breaker design with the requirements of present operating practice.

It is generally agreed that arcs, whether in air or in oil, are an electronic emission from a heated cathode (which may be either molten metal or incandescent gas) in an electric field. For alternating-current arcs in air which are drawn out in length there comes a time when for each cycle the current tends to remain at zero and increases only when the reverse voltage reaches a value sufficiently high to strike through the conducting path. Inclosing the arc in oil does two things: it cools the arc stream and increases the delay of reforming for each half cycle, and due to its insulating qualities requires a higher voltage to re-establish the arc for each half cycle. Higher contact opening speed gives a greater distance for each succeeding half cycle voltage to re-establish the arc and therefore requires a higher voltage. The arc path is naturally very much disturbed in oil both as to direction and conducting mediums, inasmuch as the conducting vapor varies as to quantity and quality along its length.

Typical oscillograms of arcs in air therefore show fairly uniform current values gradually decreasing as the arc length increases, with the current showing an increasing tendency to remain at zero, whereas arcs under oil show irregular peaks with the same tendency for the current to remain at zero. This zero lag represents the time necessary for the voltage to reach a sufficient value to re-establish the arc. Apparently the insulating value of the oil plays a minor part during the actual arc, since even as much as ½ in. of the usual oil will withstand the circuit voltage, whereas the oil circuit breaker arc is maintained for from 3 to 20 in. or more of contact travel.

The reason that contacts which move edgewise through the oil show less disturbance for the same duty, why high-speed arcing tips that have a rolling motion show less burning and less tendency to freeze and why, other things being equal, multi-break switches seem to show superior operating characteristics will all be explained and utilized when the fundamental reactions are studied from the viewpoint of the physicist rather than the mechanic. There is no indication in present-day breakers that the results of such studies are available. As evidence, the usual method of oil circuit breaker rating calls for the voltage on the circuit multiplied by the first half cycle of arc or in some cases only the R.M.S. current interrupted, whereas the thing that causes trouble is amperes in the arc and voltage across it—that is, kilowatts inside the circuit breaker tank in which recovery voltage plays a very important part.

Methods of Operating Breakers

Originally oil circuit breakers were entirely manually operated, but as the art developed the method of operating changed to compressed air and hydraulic devices and later to the use of electric power, principally through the application of solenoids.

In some of the first high-tension breakers made above 60 kv. the phases were opened individually by air pressure. Later all three phases were opened simultaneously from the same air cylinder. The advantages of electric operation, particularly by storage battery, was realized very early in the development of the art, and for several years only the completely manually operated and the storage battery operated solenoid received any attention. Within the last few years the use of relays and automatic equipment on networks covering large areas have made necessary the use of circuit breakers in locations where it is difficult to install and maintain storage batteries of a type and size necessary for satisfactory operation of available solenoid controls. In addition, as the size and weight of the equipment to be operated increased, the batteries and control wiring

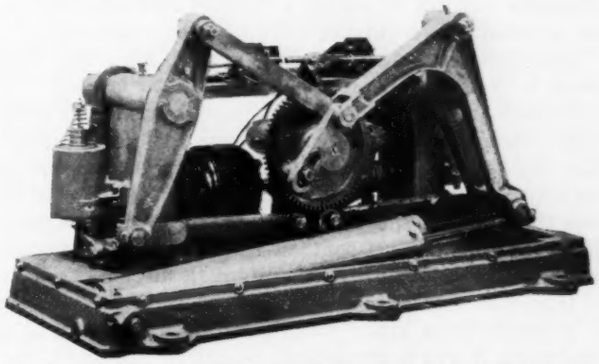


FIG. 1—OIL CIRCUIT BREAKER OPERATING MECHANISM USING STORED MECHANICAL ENERGY

became unwieldy, the extreme case being high-voltage breakers requiring well over 200 amp. at 125 volts for closing.

To alleviate such conditions a return to various expedients has been made, including hydraulic, several combinations of air operators and many alternating-current combinations, both motor and solenoid. In general, present-day circuit breakers are closed by one of the means discussed above, but opened by gravity, often assisted at the start of the stroke by a spring in which some energy is stored at the end of the closing stroke. However, in certain multiple-break switches the moving member rotates horizontally, and mechanical means must be provided for opening as well as for closing.

REQUIREMENTS OF OPERATING MECHANISMS

Operating mechanisms of oil circuit breakers should:

1. Close positively and lock the breaker closed, preferably by some form of toggle definitely limiting the travel as well as any rebound.
2. Have full mechanical trip free characteristics.
3. Open the breaker by positive mechanical action and lock full open, allowing no rebound.
4. The time-travel characteristics should be such that high speeds are available without shock and without complicated mechanical devices, especially as parts of the breaker.
5. Adjustments must be easy to make and maintain and should not be critical. There should be no adjustments necessary on the breaker other than its mechanical alignment in order to allow the operating mechanism to function.
6. The operating mechanism should function with a minimum power input from thoroughly tried and available sources and be flexible as to power demands.
7. The cost should be low enough that it is economically feasible to supply a finished mechanical product to conditions requiring circuit breaker economy.

Operating experience indicates that high speed of break is essential in a successful oil circuit breaker. In such cases as have seemed to indicate a maximum speed which should not be exceeded there are things other than the speed of break that influence results. One of the contributing causes is a shape and size of contact such that at high speeds a space devoid of oil is formed following the moving contact. The failure or partial failure of several types of quick break mechanisms can be traced to this effect, because they were called upon to function in a space practically devoid of oil at a time when it was most needed.

There are combinations of circuit breakers and operators on the market in which the speed-time cycle is totally reversed from what is desirable. They have a high speed at the time the contacts are fully closed, giving bad mechanical shocks, and a low speed as the contacts open, drawing a long arc. No amount of operator design will cure the troubles of an oil circuit breaker fundamentally wrong. However, with the same circuit breaker an operator giving a high speed of contact travel with minimum shock has decided advantages.

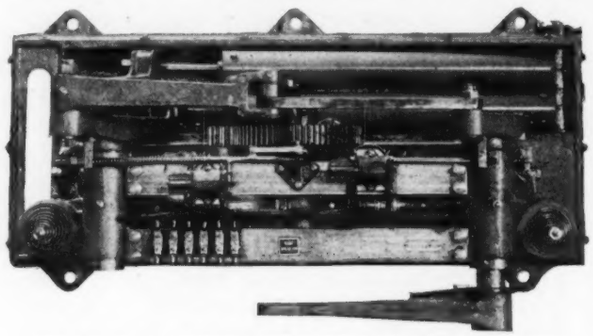


FIG. 2—PLAN VIEW OF OIL CIRCUIT BREAKER OPERATOR

Given the equipment for such high speed, as much of the mechanism as possible should be located outside the circuit breaker in a readily accessible position—that is, in the operating mechanism. Above all, hair trigger adjustments are to be avoided, because although some large central stations may be able to employ exceptional talent for their maintenance, the average circuit breaker will have to perform with just average mechanical maintenance.

OPERATOR USING STORED MECHANICAL ENERGY

In an attempt to fulfill the requirements mentioned there was developed under the writer's direction an operating mechanism[1] consisting of a ¼-hp. motor, which stores energy simultaneously in two springs and finally locks these springs by toggles. By virtue of a floating fulcrum and a combination of lever arms one spring tripped by toggle action closes the breaker and locks it closed, leaving the second spring held by a toggle ready for instant opening. Breaking the second toggle opens the switch by means of the second spring and locks it open by action of the closing toggle. Thereupon the motor automatically rewinds both springs.

The time required for rewinding is a function of the size of the motor and the energy stored, and for those operators now in service using ¼-hp. motors the time is from seven to ten seconds, with about 5,000 in.-lb. available at the beginning of either stroke. This time can

[1]Application for patent rights has been made and tentative arrangements for manufacture on the Pacific Coast have been completed.

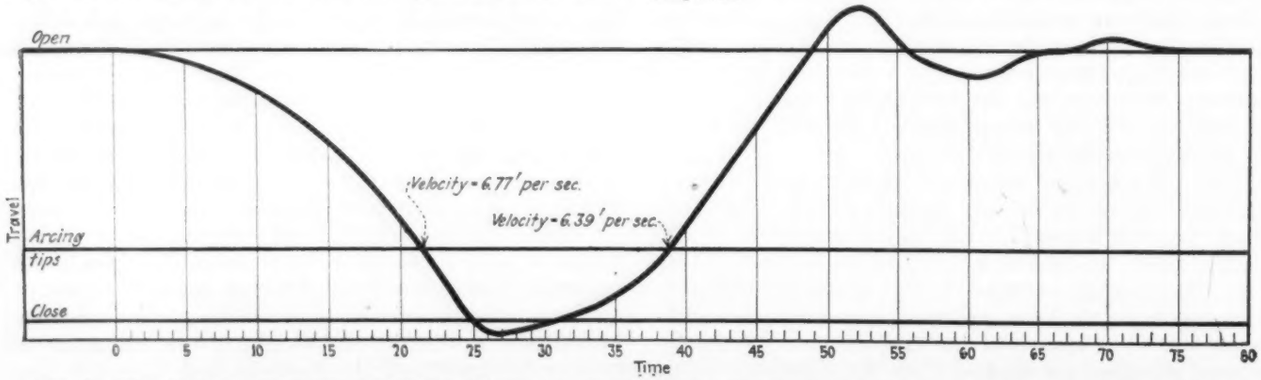


FIG. 3—TIME-TRAVEL CURVE FOR SIX-BREAK, 60-KV., OIL CIRCUIT BREAKER EQUIPPED WITH SPRING OPERATOR (TYPE 9070)

be shortened by using a larger motor, or with the same size motor and stronger springs a longer time for rewinding may be used. The time required between the closing of the control circuit and the starting of movement in the moving element of the switch, either opening or closing, represents the time required to break the toggle and is substantially the same on any breaker provided the same tripping coil and voltage are used. After the toggle is broken the speed of break for the operator under discussion is very high by virtue of the energy stored in the opening spring, and any considerable rebound is prohibited by the toggle locking the breaker in the open position.

Fig. 1 gives a view of one of the operators as used on a 60-kv. circuit breaker with the cover removed and shows the position of the mechanism after the switch has been closed and opened but before the motor has rewound the springs. Fig. 2 is a plan view. The relative size of the operator may be judged from the motor, which in this case was a Westinghouse ¼-hp., 125-volt, direct-current compound-wound motor. A typical operating curve on a commercial six-break switch with a contact speed of about 6½-ft. per second per break is given in Fig. 3. In this curve the recording equipment was placed on the phase farthest from the operator in order that a record of overtravel due to lost motion, spring in control rods, etc., could be secured. It is typical of many and is roughly an average condition.

Removing Seasonal Slump from Residence Business

BY W. S. LEFFLER
New York

WHERE the residence investment is dedicated to the service of the customer's lighting requirements only, the revenue and usage of this investment oftentimes drops as much as 60 per cent during the summer months.

Considering that the annual individual load factor of the residence lighting customer is only 7 to 10 per cent, with no more than 15 to 17 per cent for the class as a whole, it is apparent that the usage during the minimum summer months practically means that the investment given over to the residence customer is idle during that period.

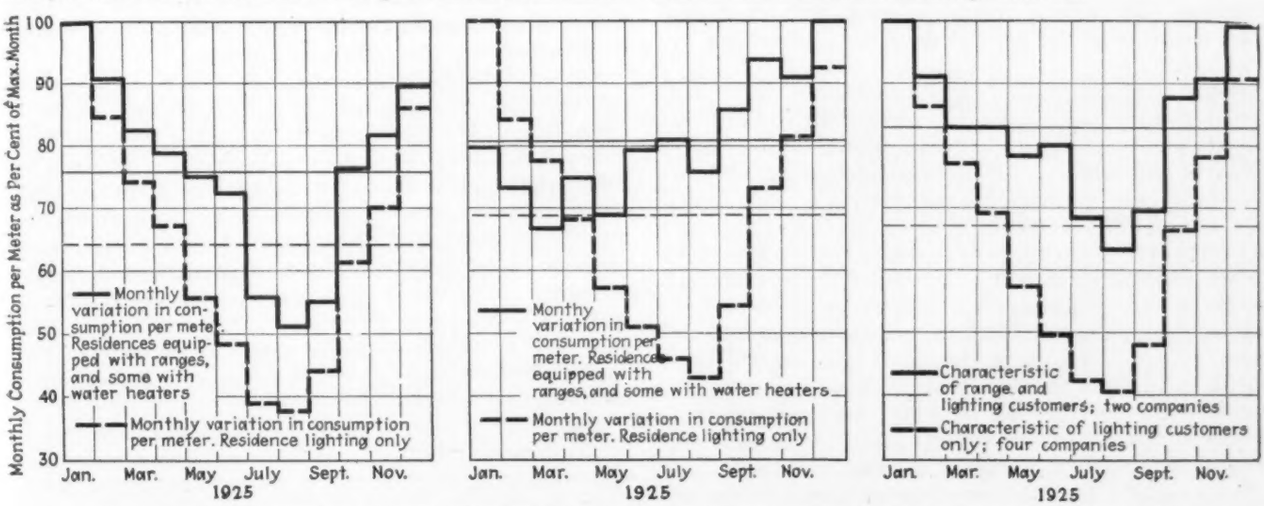
APPLIANCE USAGE REDUCES SUMMER SLUMP

In two cities where the records are segregated as between those customers who have only lighting and minor appliances and those customers who have ranges, refrigerators and some water heaters as well, it was observed that whereas the lighting variation has a maximum fluctuation of about 50 per cent, the amplified usage varied only 33 per cent in one case and 48 per cent in another.

The use of lighting investment, which in the month of August dropped 60 per cent, decreased only 37 per cent under the new conditions, or more than a 50 per cent improvement, In other words, where the over-all average use of the lighting investment is only 67 per cent as great throughout the year as it is during the month of maximum usage, the amplified domestic customer improves this over-all average to 82 per cent, an improvement of 23 per cent.

With a typical straight-line or broad-block lighting rate, the monthly revenue is naturally directly proportional to the consumption. With a properly designed amplified domestic rate structure with low follow-on steps, the revenue does not increase in direct proportion to an increase in consumption. Conversely, the revenue does not decrease in direct proportion to the decrease in usage, because a customer who uses less energy during the summer months earns a correspondingly higher average charge per kilowatt-hour for those months. Hence the summer revenues as a percentage of the maximum would be greater for amplified domestic service than is indicated by the dotted curve of the chart.

Where the residence investment is dedicated to the customer's amplified domestic service, the usage of this investment during any month should not drop below 65 to 70 per cent of the consumption during the month of maximum use and the revenue should not drop below 75 per cent during minimum months, with the average of the twelve months' revenue being as much as 90 per cent of the maximum monthly revenue.


Monthly Consumption per Meter as Per Cent of Max. Month
100
90
80
70
60
50
40
30
Monthly variation in consumption per meter. Residences equipped with ranges, and some with water heaters
Monthly variation in consumption per meter. Residence lighting only
Jan. Mar. May July Sept. Nov.
1925
Monthy variation in consumption per meter. Residences equipped with ranges, and some with water heaters
Monthly variation in consumption per meter. Residence lighting only
Jan. Mar. May July Sept. Nov.
1925
Characteristic of range and lighting customers; two companies
Characteristic of lighting customers only; four companies
Jan. Mar. May July Sept. Nov.
1925

CHARTS SHOWING HOW THE RANGE AND WATER HEATER FILL UP THE SUMMER VALLEY IN THE LIGHTING LOAD

The use of the lighting investment, which in August dropped 60 per cent, decreased only 37 per cent—more than 50 per cent improvement. The over-all average use of the lighting investment is only 67 per cent as great throughout the year as it is during the month of maximum usage, whereas the domestic customer with amplified usage increases the over-all average to 82 per cent. The increased usage has the effect of bringing about an improvement of 23 per cent.

Letters from Our Readers

Photographing Short Circuits

To the Editor of the ELECTRICAL WORLD:

In the article entitled "Effect of Cable Short Circuits on Conduit," published in the ELECTRICAL WORLD for Sept. 25, attention is called to the difference in the amount of smoke shown in two photographs of the same short circuit, one of these pictures having been taken by means of an instantaneous exposure and the other by a time exposure. This difference in the smoke shown is easily explained if it will be remembered that in the first view (No. 7) the whole picture has received the same exposure. In the time exposure, on the contrary, it is stated that the exposure was begun about three seconds before the short circuit occurred and was continued for about two seconds after that moment. When a short circuit occurs the flash and the smoke are not coincident, but the smoke follows in quick succession after the flash.

In the pictures taken with instantaneous exposures it is stated that the exposures were made approximately two and one-half seconds after the short circuit had occurred. This delay was probably due, at least in part, to waiting for the smoke to form. If the smoke is in strong evidence only in the last second that the picture is being taken, it will give only one-fifth of the exposure of the rest of the picture. It is, therefore, no wonder that the smoke should be too faint to blot out the background, as was the case with the instantaneous exposures.

G. H. MCKELWAY.

Westfield, N. J.

Value of Cost Allocations

To the Editor of ELECTRICAL WORLD:

The ELECTRICAL WORLD is to be congratulated on the step that it has taken in procuring Col. C. F. Lacombe to make a cost analysis for electric utilities, as this subject is of prime importance to the utility business. In your editorial on page 412 of the issue of Aug. 28 you state, in the beginning of paragraph 2: "Debates between cost experts on the use of class demands, peak demands, load factors, diversity factors and other technical elements in the production of cost allocations are fruitless."

Based on my experience in cost analysis and rate matters, I find that I am not in agreement with you in this assertion. In a particular case, in which the writer acted as consultant, two different bases of dividing the investment between classes of service made it difficult to determine whether the rates for residential lighting or industrial power should be increased or decreased. Surely a matter as important as this cannot be dismissed lightly in a determination of costs of service, irrespective of the purpose for which they are used. There are certain classes of investment in all public utility service that have no definite, individual use and must be divided on some basis, arbitrary or otherwise, and in many properties this investment will constitute the major portion of the entire property.

I am certain that the percentages shown in the example by Colonel Lacombe could be radically changed and the results just as logically justified. Would it not be a valuable contribution to the industry to have Colonel Lacombe describe the basis upon which he segregates investment and expenses to the various classes of service? It is conceivable that two equally fair-minded analysts could from the same set of figures arrive at different values showing the relative merits of each class.

D. F. MCCURRACH,
Statistician and Rate Engineer.

Northwestern Electric Company,
Portland, Ore.

Trial of Engineering Work as a Prerequisite to Technical College Course

To the Editor of the ELECTRICAL WORLD:

There appears from time to time in the technical press considerable discussion on the oversupply of technically trained men being turned out by the colleges year by year. Various suggestions are made to decrease the volume and improve the caliber of our future engineers. Some educators believe in stiffening the course of study by extending it to six years in length or requiring a college degree before admitting a candidate to the professional school. Others would apply psychological tests to determine a man's mental capacity for engineering training. Still others favor co-operative engineering training, a recent development that holds promise of wide adoption.

While it is true that a good many candidates for engineering training are eliminated by rigid entrance requirements and careful selection during the freshman year, quite a number of engineers are graduated each year who are bound to be disappointed in the prospects that the profession offers. Some men are natural-born engineers and will succeed with or without extended formal training; others with the best of schooling will often get into routine jobs, while many will follow the line of least resistance and take the first job that offers and develop into positions with varying degrees of responsibility.

What better method for the selection of the best material for engineering training could be found than to let the unlikely candidates eliminate themselves? I believe that if the engineering schools had a uniform entrance requirement of at least one year, and preferably two years, of continuous engagement in minor engineering work following graduation from high school, a good many who now enter engineering colleges would be diverted into other lines of endeavor.

Such practical contact with industry for a year or two would be of value alike to those who were thereby induced to follow some other work and to those imbued with the desire to follow their college course through to completion. Such as found themselves disinclined to follow engineering work because of lack of aptitude or interest, or because of dissatisfaction with the financial rewards to be expected, would be saved several years of time. Those who found themselves in the sphere of activity for which by temperament and inclination they were well fitted would pursue their college course with greater interest and a better knowledge of the value of the courses given.

Even though not a requirement of the colleges, I would recommend this course to any young man that expresses an interest in and a desire to enter engineering work.

FREDERICK KRUG,
Assistant to President.

Porto Rico Railway, Light & Power Company,
San Juan, P. R.

Central Station and Industrial Practice

Rotor Skew of Small Motors

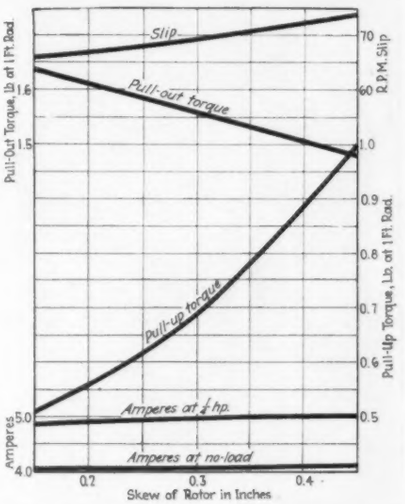
By Robert B. Treat

SMALL motors have a number of important characteristics that may be varied within limits to suit the requirements of a particular service. Some of these are: Current drawn from the line at starting, current used when the motor is delivering its rated output, efficiency, power factor, ability to start a friction or inertia load (called pull-up torque), ability to carry momentary overloads (called pull-out torque), and others.

Wide variations in the values of pull-up torque and pull-out torque were noted when comparing the test figures of many hundred ¼-hp., 110-volt, 60-cycle, single-phase, split-phase starting type motors. It was discovered that small variations existed in the rotor skew or the angle of the rotor bars to the shaft of the rotor.

A series of tests was made by subjecting a rotor to successive amounts of skew. The results are plotted in curves showing the effect of skew upon several of the motor characteristics. The motors under test had a full-load torque rating of 0.76 lb. at 1-ft. radius. The stator had a bore of 3.5 in. diameter and 24 slots, so that the pitch of the stator slots was 0.458 in. The rotor which was tested in this investigation had 31 slots and bars.

A study of the curves indicates that the pull-up torque increases rapidly with the skew, whereas the pull-out torque decreases with the skew. It will be noted that the slip or drop in speed below synchronous speed at full load of the motor increases with the skew and the full-load current increases slightly with the skew likewise.



CURVES SHOWING RELATION BETWEEN ROTOR SKEW OF SMALL MOTORS AND TORQUE VALUES OBTAINABLE

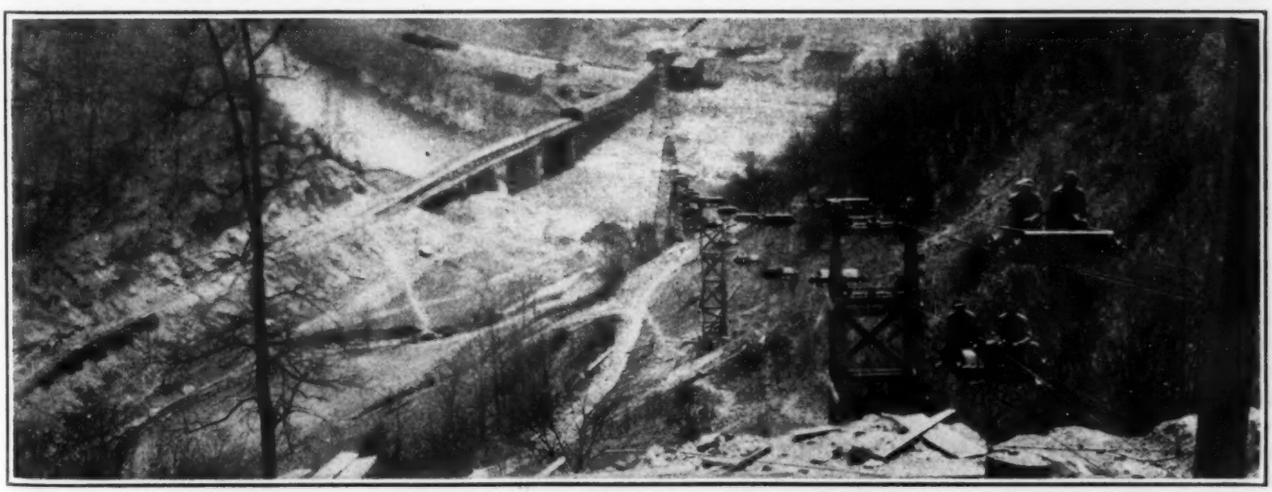
Designers have been known to change stator windings, air gaps, rotor bars, end rings, etc., in order to obtain different values for the torques. These curves show that in many cases the results may be obtained simply by changing the rotor skew.

Interlocked Conveyor System Pays Its Upkeep

AN INTERLOCKED conveyor system used by the Lincoln Coal Company at Napfor, Ky., conveys coal from a new mine to the tipple, operating automatically and paying for its own maintenance by means of regeneration of electricity.

The tramway is of the automatic continuous carrier type and operates over a distance of 1,800 ft. with a drop of 360 ft. from the loading to the unloading end. It has a capacity of 150 tons per hour. The system is started by a 40-hp. motor, which, after the speed builds up, acts as a generator and feeds power back into the line. The motor also by this regenerative process acts as a brake, thus preventing the conveyor from running away. The power fed back into the line is used by other motors on the system, such as the screen motor. A solenoid brake is provided for the purpose of stopping the conveyor in the event that a failure of power were to make the motor inoperative for braking.

Two mines are operated by the Lincoln company at this point, both on the same side of a river, whereas the tipple is on the other side of the river. Coal is transported from the old mine to the tipple in cars drawn by electric locomotives, and the supply from the new mine is delivered at the tipple by the automatic conveyor system. Both supplies of coal



VIEW OF THE CONVEYOR SYSTEM FROM THE RECEIVING END, THE HAULAGE SYSTEM FOR THE OLDER MINE AND THE COMMON TIPPLE IN THE DISTANCE

are delivered to the same screen and after screening are loaded on cars on three different railroad tracks.

Coal is taken from the new mine in one and one-half-ton cars, which discharge into a weigh basket at the head of the tramway. From the weigh basket a Jeffery reciprocating feeder deposits the coal on an apron conveyor used as a picking table, which, in turn, deposits the coal in an undercut gate emptying into the main tramway loader. The tramway cars, each one of which has a capacity of 1,000 lb. of coal, pass through the receiving terminal of the conveyor system at ten and one-half second intervals.

The motor that furnishes the power for starting the system through the moving cable is located at the receiving end of the system. Another motor drives the picking table and feeder, both motors being controlled by push buttons at the tipple, 1,800 ft. away.

Among the advantages that have resulted from the automatic conveyor system are: (1) reduction of labor as compared with the older haulage system; (2) reduction of operating cost, the power delivered back to the line more than paying for the maintenance cost, and (3) minimum breakage of coal, there being no drops and very little sliding in handling.

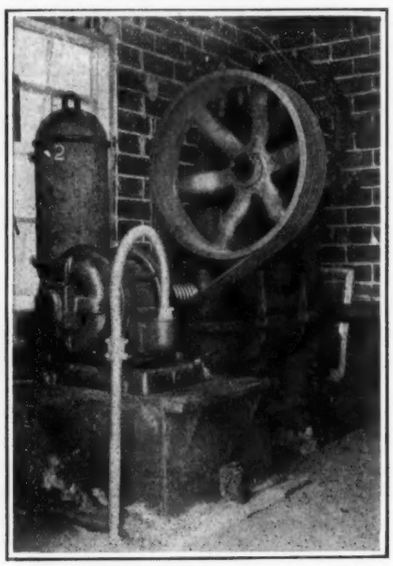
Cost of Making Some Meter Operations

ACCORDING to some data made available for one district of one electric-service company, the unit cost of removing, resetting and testing meters for the last two years has averaged about 63 cents per operation. This cost does not include overhead expense. The data available do not segregate the unit costs of removing, resetting and testing meters, but it may be pointed out that more than 23,000 meters were removed or reset and more than 7,800 were tested in the period considered.

The unit costs ranged from 39 cents per operation to $1.36 per operation, but a shotgun diagram of the monthly unit costs indicates very little conformity to any law. It may be mentioned, however, that all unit costs below the average were secured when more than 1,400 operations were performed per month and unit costs in excess of the average were obtained when less than 1,400 operations per month were involved. Still the average number of operations per month was about 1,300, ranging from 820 to 1,850.

Automatic Pumping in Pickle Plant

IN AN automatically controlled pumping outfit recently placed in operation at the plant of the Kuner Pickle Company at Brighton, Col.,



VIEW OF TRIPLEX PUMP EQUIPPED WITH MOTOR DRIVE

the pump acceleration is purposely reduced by voltage drop in the power circuit leading to the pump motors. The pumping equipment consists of two 8x8-in. Deming triplex pumps rated at 200 g.p.m. and discharging into an elevated steel tank against a total head (static plus friction) of approximately 175 ft. High starting torque motors with across-the-line starters are used for driving the pumps, which start against full discharge pressure.

In view of the excess starting torque available in the motors used, the line copper was purposely made smaller than ordinary practice would dictate, in order that some additional line drop could be secured during the starting period, the acceleration of the motors thus not being so rapid as to impose objectionable strains on the mechanical parts or objectionable pressure rises in the discharge line. Under these conditions the pumps reach full speed in about 1½ seconds, and the pressure rise caused by the acceleration of water in the water column is held to approximately 10 lb. as indicated by pressure gages on the pumps. A pressure-relief valve on this discharge line, set at 15 lb. above maximum static head, has not been compelled to operate since the outfit was put in operation.

By means of a three-pole, double-throw switch, control may be transferred from the automatic pressure governor to the standard hand-operated push button, thus permitting operation of the pumps at any time for inspection or adjustment. The pressure governor is installed on the side of the elevated tank itself, 300 ft. away from the pumps, and the control circuit is extended by lead-covered wires inclosed in steel conduit. Thus much more accurate control of the water level is obtained and the necessity for a separate pressure pipe for the operation of the control is eliminated. The governor is protected from freezing in cold weather by an inclosing case in which two 60-watt lamps are installed as heaters.

As simultaneous starting of both pumps would involve objectionable power demands and serious excess pressures in the water column, sequence starting is very important. By means of a definite-time relay, one pump starts immediately after the pressure governor operates and the other starts 30 seconds later. Either or both pumps may be operated as conditions may require.

Melting Brass in the Electric Furnace

YELLOW brass has been almost universally adopted in brass rolling mills, and at the present time a similar revolution is taking place in general foundry practice. According to data issued recently by the Bureau of Mines, the United States is leading the world in the electric brass-melting field. At present there are about 275 induction-type furnaces, 135 moving indirect-arc furnaces and 130 furnaces of other types, making a total of about 540 electric furnaces used for melting non-ferrous metals.

In fuel-fired furnaces the two largest items of cost are the loss of metal by volatilization and the cost of crucibles, the cost of either over the electric furnace being in many cases more than the cost of the electric heat. The loss of metal is a serious problem. From reliable figures as obtained from 200 or more plants by the power committee of the N.E.L.A. and reported in publications of 1925-26 the net metal loss,

allowing for all recovered metal, has been found to average in excess of 2½ per cent of the metal melted and to run in some instances as high as 8 per cent.

Due to the low thermal efficiency of fuel-fired furnaces and the relatively high efficiency of the transfer of electric heat it takes much less fuel to generate the necessary amount of electricity for melting than it does to use the fuel direct.

It is evident from the factors influencing the melting of brass in fuel-fired furnaces that the many disadvantages are due to the unavoidable presence of gases of combustion. Since the correct solution of the problem is the elimination of the source of the trouble rather than a correction or limiting of the effect, the electric furnace has been demanded as the method of entirely eliminating the harmful influence of consuming and contaminating gases. The electric furnace fills the ideal requirements, largely by the absence of gases in contact with the metal, so that its eventual use, wherever electricity is available, is assured.

Although little data are available for publication relative to the improved quality of various electrically melted alloy or the same alloy from a fuel-fired furnace, it has been found that a very much more uniform quality of metal and a metal more closely running to specification can be produced. Sponginess of castings is greatly reduced, because of the freedom from oxygen and the gases of combustion in the electric furnace. Blistering from sulphur is also eliminated and the tendency of uneven shrinkage is much reduced.

125-kw., 750-lb. furnace
Melting 85 per cent copper, 5 per cent tin, 5 per cent lead, 5 per cent zinc
Production—6,500 lb. per day.

Melting Cost per Ton

Power: 280 kw.-hr. at 1¼ cents	$4.90
Electrodes: 3½ lb. at 22 cents	.72
Refractories: 1,600 heats per lining	.40
Maintenance: Supplies, repairs, etc.	.25
Labor: Operator at 45 cents	1.32
Metal loss: 0.5 per cent, or 10 lb. at 12 cents per pound	1.20
Overhead, 16 per cent—interest, 6 per cent; depreciation, 10 per cent	1.05
Total cost per ton	$9.84

Foundries melting red brass and bronze mixtures nine hours per day are reporting an average power consumption in the electric furnaces of 270 to 290 kw.-hr. per ton. With yellow brass mixtures on the same class of work, this average is 250 kw.-hr. per ton. One of the rolling mills referred to melted 500 consecutive 2,000-lb. heats of 60-40 yellow brass at an average consumption of 224 kw.-hr. per ton; 50 consecutive heats showed an average 215 kw.-hr. per ton, the furnace operating during this time fifteen hours per day. On several occasions a dozen or more consecutive heats averaged less than 200 kw.-hr. per ton, while individual heats have repeatedly been poured at 170 to 180 kw.-hr. per ton. The metal loss from this high-zinc alloy varies from 0.7 per cent to 1 per cent at the most.

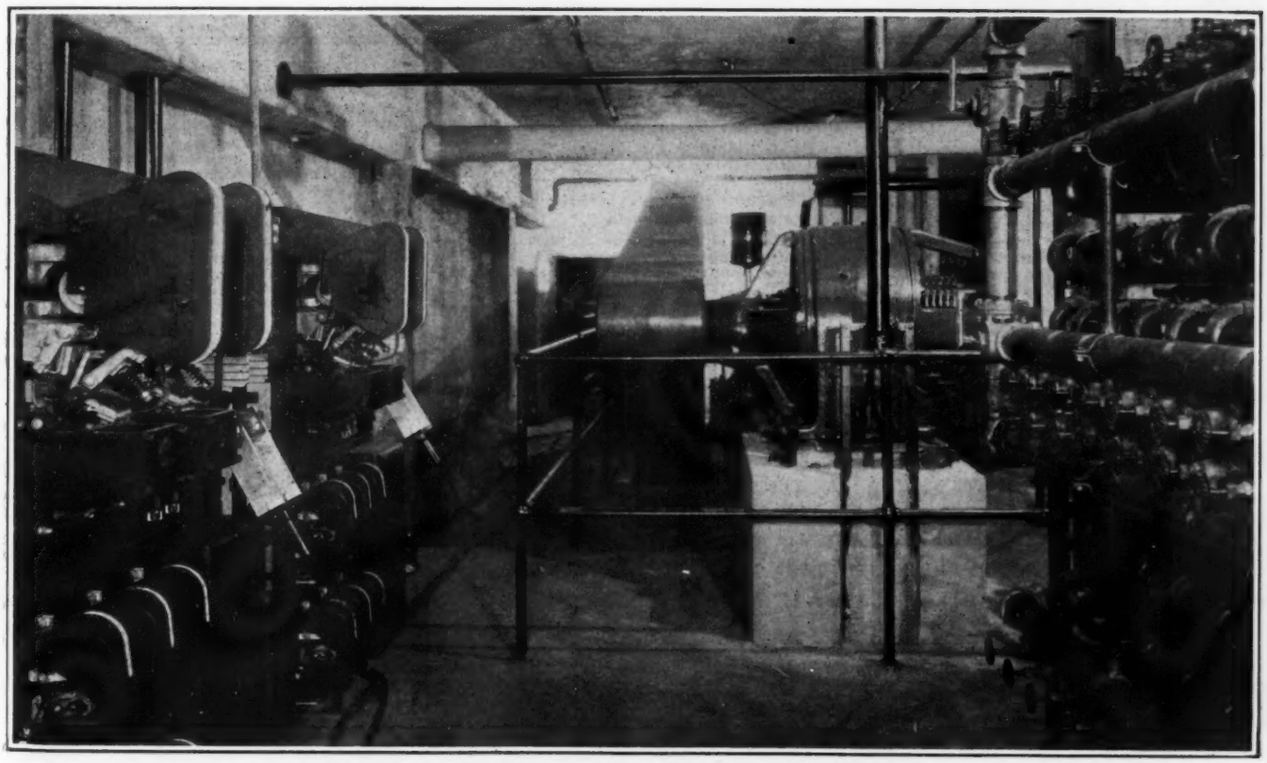
Operating a furnace of smaller capacity nine hours per day on red brass or bronze, pouring sand castings, the results shown in the accompanying table were obtained.

Cooling System for Theater

THE Metropolitan Theater in Boston is probably the first theater in New England to attempt a cooling system for an entire auditorium. Two refrigerating compressors were recently installed for this purpose.

Two 150-ton Wittenmeier refrigerating compressors are used for chilling water, which in turn cool the ventilating air by means of a large air washer. It is expected that the temperature in the auditorium will be maintained near 70 deg. F. in both winter and summer.

The compressors are electrically driven by two 165/200-hp., shunt-wound motors, each belted to one of the compressor units and each controlled by a special series contactor type automatic starter with a separately mounted field rheostat and a push-button station.



ONE OF TWO 165/200-HP., 500/600-R.P.M., 230-VOLT MOTORS WITH BELT DRIVE TO COMPRESSORS, COMPLETE WITH AUTOMATIC STARTERS

Conjectures and Speculations

NATURE'S ELECTRICITY AND THE WEATHER

BY C. L. KASSON
Edison Electric Illuminating Company of Boston

IF AN antenna is connected to ground, a current of electricity will flow. This can be measured by a galvanometer or D'Arsonval micro-ammeter.

1. The current is of the nature of direct current.

2. The flow may be in either direction.

3. The magnitude for an ordinary radio-receiving antenna may vary from zero to a positive or negative maximum of ten or even more micro-amperes.

4. A resistance of several thousands of ohms may be inserted in the circuit and the current will still flow, although its value is lower.

From this it may be deduced that a difference of potential exists between the air and the earth, which varies from a positive maximum through zero to a negative maximum depending on conditions; further, that there is an electric energy interchange between the air and the earth under these conditions; further, that this is not energy from radio broadcasting, since the indications are obtained on D'Arsonval instruments.

From these deductions it would appear that the indicated energy is nature's electricity in the atmosphere and earth. This is probably due to solar action.

From this it may be argued that solar energy passing through our atmosphere is apparent as electricity and further manifest as light and heat depending upon the media through which it travels.

The air, our atmosphere, is normally a uniform dielectric, but under storm conditions this dielectric is non-uniform and the density is much greater where the storm clouds are.

Solar action puts the atmosphere under stress similar to any dielectric under electrical stress. The air must then have an energy content per unit of air in planes parallel to the earth's surface. A storm is a concentration of this energy in small areas, with accompanying great stress gradients.

Now, by experiment, it has been found that on a cloudless fair day the direct-current flow in an antenna circuit is so small that a galvanometer capable of reading 10^{-9} amp. will not indicate it. This is the balanced condition when there is very little electric energy interchange between the air and earth at the given point. On a day when a heavy cold fog existed, the reading has gone as high as 10 micro-amperes or more with the air positive.

Apparently the values obtained are directly related to the local weather conditions and the polarity depends upon whether it is day or night and upon whether the storm is making up or abating.

From the foregoing it may perhaps be deduced that the weather is due to energy interchange between the atmosphere and the earth; further, that this is both a general and a local action. The energy interchange is related to the air density (barometric pressure), moisture content (humidity) and wind. These are all in turn related to temperature gradients and thus to what might be called the local heat balance.

What establishes these local heat balances? The transfer of energy!

What causes this energy transfer? Nature and possibly the unconscious mass action of life.

Montaup Construction Costs

FROM an exhibit recently filed with the Massachusetts Department of Public Utilities by the Montaup Electric Company, Fall River, Mass., the following data were secured upon the construction costs to March 31, 1926, of the Somerset steam plant, Somerset outdoor substation and Fall River outdoor substation. Stone & Webster, Inc., are engineers for the company:

SOMERSET STATION, MONTAUP ELECTRIC COMPANY, COST TO MARCH 31, 1926 (TO NEAREST DOLLAR)

Land, station site, Somerset	$190,633
Water supply, Somerset	171,716
Water supply, Dighton	15,483
Wharves and bulkheads	393,204
Dredging (basin and intake)	118,095
Dam and pump house	40,456
Pipe line	120,421
Yard work, including clearing, fencing, grading, retaining walls, drainage, trackwork, driveways, service lines, test borings	153,419
Building complete, including service equipment (present capacity, two units, one of which was installed at time these figures were filed)	1,489,394
Equipment foundations, including turbine foundations, stack mats and auxiliary foundations	72,742
Boiler plant, including three 1,492-hp. boilers with superheaters, settings, fuel oil equipment, soot blowers, etc.	418,341
Draft system, including one 200-ft. concrete stack, uptakes, flues forced and induced draft systems, cinder removal and combustion control	155,823
Feed-water system, including feed-water heaters, boiler-feed pumps, water-purification system, surge and storage tanks, economizers, miscellaneous pumps	181,720
Condenser system, including screen well and equipment, intake and discharge tunnels, one 50,000-sq.ft. condenser, circulating water piping, etc.	647,590
Piping and covering	$301,262
Fuel oil handling equipment, including service tanks, oil pumps, heaters, strainers, meters and piping	73,838
Pulverized fuel equipment	39,375
Generators, including one 32,000-kw. turbo-generator, exciter, air coolers, ducts	685,638
Transformers (station light and power)	27,600
Switch gear and wiring	495,468
Auxiliary equipment, including lubrication systems, station cranes, compressed air equipment, instruments, pumps, painting	120,978
Building equipment, office	8,333
Shop	11,200
Stores	1,130
Transportation	1,487
Laboratory	570
Miscellaneous	728
Testing apparatus and equipment	23,230
Fuel oil storage plant, including two 55,000-bbl. steel tanks with fire protection, dikes, pump houses and piping	189,048
Total power station	$6,148,924

SOMERSET OUTDOOR SUBSTATION

Yard work, including fences, gates, drainage system and cable tunnel	$16,126
Equipment foundations, including foundations for main arbor and miscellaneous equipment of outdoor type	$37,578
Electrical equipment, including four 12,500-kva. transformers (14/66/115 kv.)	186,676
Switch gear and wiring, including main arbor, structures, switch and control equipment, connections, supports and protective equipment	247,181
Transformer repair house complete with service equipment, one 30-ton crane, oil purifier, pumps, etc.	48,453
Total outdoor substation	$536,015

FALL RIVER OUTDOOR SUBSTATION

Yard work, including neutral resistor bus, lighting and fencing	6,719
Equipment foundations, including foundations for outdoor substructure and transformer repair house	35,383
Electrical equipment, including four 8,333-kva., 66/13/2.3-kv. main power transformers, oil-cooling and purifying system	137,695
Switch gear and wiring, including steel structures for outdoor substation, switch and control equipment	98,918
Transformer repair house, superstructure only	11,207
Total outdoor substation	$289,923

Commercial Activities and Public Relations

"Lighting Consciousness" and Better Market Development

By W. S. Mowry
Power Engineering Department, Worcester Electric Light Company

THE development of a "lighting consciousness" on the part of the public is slowly taking place, and it is significant in relation to future market cultivation. People are more ready than ever before to accept ideas and interpretations of proper, adequate and softened light. Interest awakened in regard to one part of a plant always causes the individual to observe the defects of lighting in other departments. He begins to look upon lighting as an effect and not as a source. This is "lighting consciousness," and at least for the particular individual keeps growing until he begins to question why he should not have as good light in his home as in his office.

In a typical case an executive office has a fixture, two brackets and a lamp costing $600. Along comes a request to modernize the lighting of this office, and the job must be done without discarding an expensive and a decorative fixture. The situation is similar when the home owner considers buying new fixtures. Unfortunately many fixture manufacturers and fixture salesmen lack "lighting consciousness," or if they have it at all, it never comes to the surface at the time of the sale. Competition and other factors force them to push upon the customer's hands a lot of silver-finished and other decorative types, often with bare lamps and frequently with units that will not give as good light as a cheap "chain and pan" monstrosity. At least these monstrosities often have some kind of glass shades and cut down the glare at the source.

To return to the householder's dilemma, what is to be done? Glass shades are rather ordinary, although accomplishing a result. Silk appeals more to the housewife's taste, but their selection may be haphazard or given up because of buying a "fixture" of indifferent design; or again, the purchaser may decide to make the shades herself. The percentage of fixtures sold with shades is exceedingly small, and assuming the housewife makes her own shades, the result is almost sure to be a poorly lighted room. Color and decoration enhance the appearance of a room, but we must have adequate lighting as well. There is a marked tendency toward the use of a multiplicity of lights in these cases without proper regard to their selection and distribution.

The day will soon come when we shall see the use of gas-filled, high-efficiency, higher-wattage lamps in the home. Very few one-lamp fixtures are at all adaptable to home lighting. A few leading research men in the lighting business will design a fixture that will meet the decorative and period requirements of the architect or owner. The fixture manufacturer, I believe, is unlikely to do this, and for the average home owner a ready-made fixture is the only thing he can buy.

The indicated general solution of the problem is along the lines of the use of semi-indirect fixtures built for home or commercial applications; the adaptation of other indirect or semi-indirect commercial fixtures to the home (accomplished principally by the use of the silk shade) or the design of such fixtures as will meet home requirements and give a quantity of soft light, well-distributed and adequate for reading, sewing, study, social and all other purposes of the rooms where the people spend a large part of their lives.

Back to Business*

Demonstrating by Action that the Utility Business Is a Business Like Any Other Will Solve Many Problems

By H. E. Young
Commercial Manager Minneapolis General Electric Company

IN ANY other business you can think of, selling of the product made is of prime importance; all other factors are relatively insignificant. To my mind many of the so-called problems of our business have arisen from the fact that we have not treated it as a business, but as something else. The reason is that we have not had to get out and hustle to sell our product as have other businesses. As a result our attention has been focused upon other factors and, in turn, these have been reflected upon the public mind to such an extent that the public has become educated to feel that our business is not a business.

Propaganda has been broadcast in an effort to educate the public that we are a utility, that we are a natural monopoly, that we are a lot of things that an ordinary business is not. The public has heard nothing of our problems in the manufacture, sale and distribution of our product, which are the only problems they hear about in connection with any other business.

Is it any wonder, therefore, that they look upon us as an entirely different kind of animal? Is it any wonder that they have come to accept our statement that we deal in something that is a public necessity? Is it any wonder that they have come to feel that we should be regulated by law in the handling of this public necessity?

A Form of Competition that Exists

If it were true that we had no competition, were a monopoly, had the field of business all to ourselves and were able to charge whatever price we liked, it would indeed be fortunate for us, and we could hardly expect other than regulation. However, there is just as much competition in every phase of our business as there is in any other business. The sale of power, for example, which constitutes a large part of our business, is in direct competition with power manufactured in numerous other ways. Electric service to all large buildings must be provided at a saving to the owner or he will put in his own plant. Providing such service keeps our sales force busy proving that we can show a saving and keeps our industry busy developing ways and means of supplying energy cheap enough to show such a saving. If there were any

*Excerpts from address presented before the Nebraska Section, N.E.L.A.

marked profit in the residence lighting business, it would immediately be an invitation for some competing source of light.

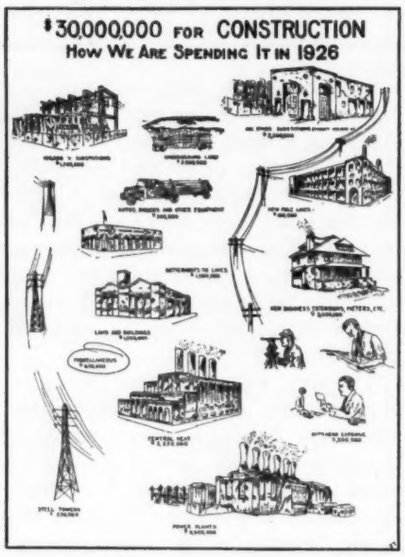
How often do you find two electric companies doing electric business in the same town or city? Very rarely, and why? Because there is only a reasonable profit for one and no profit for two. Although in some states regulation prevents competition in the same locality, let no one think that state regulation is the cause for this, as competition would not take place even without regulation. For example, in Minnesota and North Dakota and many other states there is no regulation; furthermore, in Minnesota it is against the state law for a town or city to grant an exclusive franchise to any one company. Still, in Minnesota there is not a single town or city at the present time that has two companies doing business in the same locality. Regulation is not responsible for this, but simply economic laws.

We have to go further than the average business. If we conduct our business in such a way as to antagonize the public, there is always a faction ready to induce municipal ownership. It may be that the company is doing business on the most economical basis and that a municipally owned system could not begin to do as well, and yet, without proper treatment of the public, a municipally owned business might start operation.

If there is one thing our industry should accomplish in the next era, upon which it is now apparently entering, it is the education of the public, by demonstration, of the fact that our business is a business pure and simple. To do this, conduct it as a business—not as a utility, not as a public necessity, not as a natural monopoly; not as anything else, but a strictly legitimate, ordinary every-day business. The way the public gets the impression from most businesses as to their problems is by the every-day evidence it has of their activities. The public sees them every day striving to get business, striving to make sales, striving to make economies. It does not see them putting out propaganda in an effort to justify their position, it does not see them conducting a public relations department—unknown in any other line of business but our own.

If we have a problem of public relations, it is nothing more or less than a lack of something else, and the sooner we find out what is lacking and bring it into play the better. If we have need of public relations activities—which we do—let them be accomplished within our organizations and let every employee be a factor.

How the Detroit Edison Portrays Expenditures



THIRTY MILLION DOLLARS is being spent by the Detroit Edison Company for construction work on its properties during the present year. The accompanying illustration indicates approximately the amounts to be devoted to particular branches of the proposed program of undertakings.

Public Utility Has Own Printing Department

BY CONRAD SWEARER

WHAT is believed to be the only undertaking of its kind within a utility organization in this country at the present is functioning as a department of the Consolidated Gas, Electric Light & Power Company of Baltimore, and is saving to the consumers of gas and electricity quite a lump sum of money every year. This reference is to the printing department, the development of which has opened a way to many economies in the origin and use of printed forms, the handling of stationery items and storeroom practice.

Organized in the early part of 1922, at a time when the printing bills of the company amounted to approximately $92,000 a year, the department has been enabled, by close co-operation with a committee on standardization and supplies and by making use of various expedients directly affecting the actual printing, to perform 98 per cent of the company's printing in 1925 at a total cost of $53,897.58, which figure includes paper, supplies and an overhead allowance sufficient to clear the expense account.

The ratio of increase in the company's printing, established in 1920, was around 15 per cent. Carrying in that same ratio through the succeeding years would bring the 1925 figure, if the printing requirements were fulfilled by commercial printers, up to $160,000. This latter figure, however, should not be taken literally and interpreted in such a manner as to indicate that the company's printing bill would be today around $160,000 annually, for it is possible that some of the expedients made effective would have followed in the natural course of events. It was mainly on account of the expedients that were used, plus the low cost of operating, that permitted closing out the year at such an apparently ridiculous figure, after considering the proportionate rate of increase.

Starting essentially with a service department making use of multigraph and mimeograph machines, the department has developed, step by step, until today it numbers twelve employees and makes use of equipment capitalized at $22,290. This figure does not include the value of the type composition matter represented in the forms kept standing, an additional amount estimated at $14,000, but which has all been absorbed in the overhead charges.

There are approximately 1,500 stock forms in use in the company at present, and as effective changes leading to standardization and simplification have been made, the plan of doubling up in the pressroom has been accomplished to a great extent.

The printing department reached a point in its development during the early part of 1925 when it was able to take care of 98 per cent of the company's requirements. This condition almost coincided with the completion of the work of standardization by a standardization committee with the attendant refinement of routine and control that follows standardization. The results of this program are clearly reflected by a comparison of stock balances, value of issues from stock, number of issues and the rate of turnover between the business handled in 1925 and that of the previous year.

The plant itself has been a revela-

tion to the company in the amount of work it does and the service it renders. It has no peaks and valleys to contend with such as the commercial printer experiences. There is never a dearth of orders but always plenty ready and waiting to go on the presses.

"Electric Power Cable—The Industrial Life-Line"

VISCOUNT ROTHERMERE, publisher of the London *Daily Mail*, recently indicated how highly American achievement is valued by a patriotic Briton who sees his own country losing ground industrially and its people lacking not only the luxuries but the very necessities of life because of Great Britain's failure to utilize intelligently its great natural resources and opportunities for electrical development. Inferentially, at least, he contrasts the inadequate power production in Great Britain, "under a petty and parochial system of meddlesome muddle," with the benefits of large-scale electrical administration in the United States, where private initiative and enterprise have had full play.

In part he said:

"World leadership in utilization of the mechanical and material resources of science now lies with the United States. The prosperity of America has in consequence reached a degree without precedent in the history of civilization, and the individual standard of living of her citizens continues to rise rapidly and uninterruptedly. The economic welfare of the United States is based more than anything else upon the fact that she has 29,000,000 hp. of electrical power established in her factories—a force that is estimated as the equivalent of 290,000,000 human workers."

The tremendous electrical power development of the United States and its application to the forces of industry have come so gradually and naturally, points out Viscount Rothermere, that its beneficiary—the American public—has accepted it as a matter of course and without proper appreciation and conscious realization of its significance.

"The result of having cheap power always at immediate call is that industrial production increases by leaps and bounds. The function of the American laborer is rapidly becoming limited to directing and controlling power rather than supplying it from his own muscles. The great increase in the production of wealth thus brought about has very largely raised the workingman's wages and his standard of life. The explanation of his prosperity can be almost entirely compressed into two words—cheap power."

Viscount Rothermere also says: "American homes are depressed by far less of the constant drudgery that disheartens so many English women. In them cleaning, cooking, dishwashing, laundry work even, can be done swiftly, efficiently and cheaply by the simple process of pushing a switch. The day is visibly approaching when practically all the hard manual work of the United States with its 118,000,000 people will be done by electricity, and done far more swiftly and cheaply than labor could accomplish it.

"These benefits, and greater ones that lie in the future for America, are due to the energy and vision with which a few leaders have grasped and solved the problem of power supply on a national scale. Standardization, simplicity and cheapness are the benefits that directly accrue from the large-scale electrical administration of the United States. Each great center of population in the United States receives its power from a single producing organization, which is generally linked, in its turn, with similar enterprises in the same range of territory, for the elimination of wasteful duplication and reduction of overhead charges.

"So fast and far is the electrification of the United States extending that unless we [Great Britain] make an immediate effort to keep pace with her, we shall soon lag as far behind America industrially as the Balkan States are behind ourselves. Where wages are high, as in America, it is found that a large supply of electrical power exists—in the United States 3.27 hp. per factory wage earner. Where power supply is absent, as in China, low wages and intense human drudgery are the rule.

"If we continue to flounder in the swamp of obsolete organization," concludes Viscount Rothermere, "we shall assuredly end in economic collapse. Our industrial life-line is the electric power cable. Without it we shall sink down, down, down into an economic abyss of immeasurable misery and destitution."

Consumers Power Participates in Reforestation

THE Consumers Power Company has seen and applied a way to benefit itself and at the same time afford some very direct benefits to the Michigan people. The opportunity presented itself in the form of co-operating with the State Conservation Department in a program of reforestation and replenishment of fish and game. The reforestation work of this company, which is now in its third year, has involved planting 55,000 pine trees and 6,000 willow cuttings along the Au Sable River, 19,000 pine trees along the Manistee River and 11,000 pine trees along the Muskegon River. During 1926 more than 2,000,000 fish were planted in the company's storage pond. Food is also being furnished for game birds and fish in the backwaters and bays of the ponds.

SIGNBOARD CALLS PUBLIC ATTENTION TO UTILITY REFORESTATION WORK

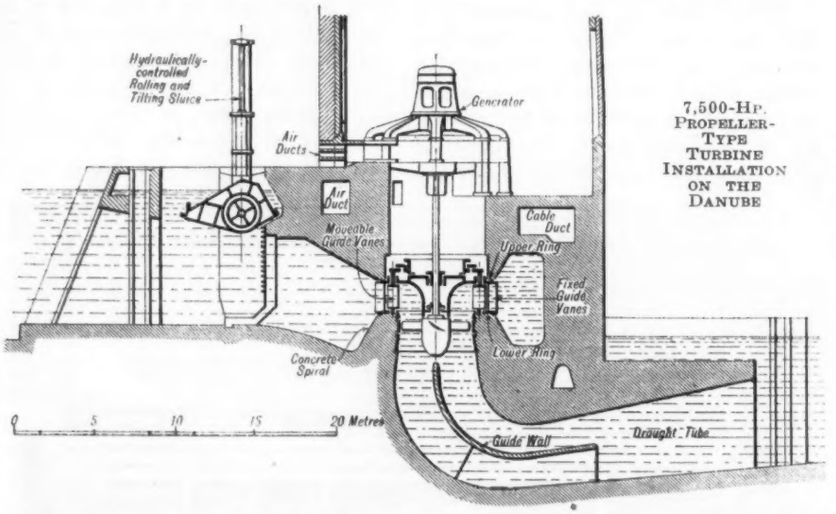
To a certain extent reforestation will improve water-power conditions by spreading out the run-off from precipitation, retarding the melting of snow, etc. However, a greater benefit will be afforded nature lovers, hunters, fishers and campers by this and other conservation work.

The accompanying illustration shows one of a chain of large painted signboards that have been erected by the company on important highways, calling attention to the properties or to features of the company's activities. This particular board is illuminated.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Propeller-Type 7,500-Hp. Water Turbine.—What is said to have been one of the most impressive of the exhibits of heavy machinery at the Inland Navigation and Water Power Exhibition at Basle, Switzerland, was the turbine runner and inlet casing of one of six 7,500-hp. propeller-type turbines now being constructed for the Kachlet power plant on the Danube. The turbine is designed for a total output of 7,500 hp. when working under a normal head of 7.65 m. and with a water consumption of 87,5 cu.m. per second, the speed being 75 r.p.m. The accompanying generator equipment is three-phase alternating, wound for a pressure of 6,300 volts. They are designed for an



7,500-HP. PROPELLER-TYPE TURBINE INSTALLATION ON THE DANUBE

output of 8,500 kva. at 70 per cent power factor. These generators may be run up to a speed of 150 r.p.m. over a certain period. This installation is considered of particular interest as it represents the largest plant of its type on the Continent of Europe.—*Engineer* (*England*), Sept. 3, 1926.

Distribution of Pressure in Impulse Steam Turbines at Varying Loads.—W. J. KEARTON.—The object of this paper is to outline a method whereby the pressure and heat-drop distribution in a steam turbine may be approximately predicted for operating conditions differing from the design conditions and to illustrate the application of the method to examples of practical interest and importance. An abundance of diagrams and charts with detailed material in tabular form is supplied with the article. In general, the pressure distribution in multistage turbines is arranged by a suitable adjustment of the nozzle area, so as to bring the ratio of blade velocity to steam velocity, at exit from the nozzles in all stages, as near to the optimum value as economic conditions will permit, when the turbine is operating at what is commonly termed its "economical load." In some designs the mean diameters of the various blade rings are all made equal, and it follows that for the same type of blading the heat drop will be the same for each stage in such cases. In other designs, especially when high-pressure steam is used and an attempt is made to realize a high efficiency, the blade rings are made relatively small in the high-pressure stages of the turbine, so as to reduce disk friction losses, the disk diameters being progressively increased toward the low-pressure end. In such turbines the heat drops are quite small at the high-pressure end and increase toward the exhaust end, varying actually as the square of the mean diameters. When the conditions of operation differ from the "economical load" conditions, the steam weight passing through the turbine may be slightly increased or, on the other hand, very much reduced, and as a result the nozzle areas will now be incorrect. Usually the weight of steam flowing through the turbine per second is diminished. This causes a decrease in the steam velocity at exit from the nozzles in certain stages of the turbine with a reduction in blade efficiency.—*Engineering* (*England*), Sept. 17, 1926.

Generation, Control, Switching and Protection

Notes on the Earthing of Metal Objects Other than Conductors.—L. HENSHAW. — The importance of earthing metal bodies other than conductors is stressed by all electrical lawmakers and is denied by few, if any, engineers. At the same time rules, regulations, etc., covering the installation and maintenance of electric plant and equipment strictly avoid specification beyond the vague expression "satisfactory." The paper suggests a starting point for investigations which would have as their objective the defining of conditions which will preclude all possibility of dispute.—*Journal of Institution of Electrical Engineers* (*England*), September, 1926.

Transmission, Substations and Distribution

Economic Base Width of Transmission Towers. — C. R. YOUNG, W. B. DUNBAR and C. E. LEWIS.—Incidental to a study of certain phases of the design of steel transmission towers begun by the authors in 1924, under the auspices of the School of Engineering Research, University of Toronto, it appeared desirable to determine the least-weight ratio of the width of base at the ground line in square windmill-type towers with suspended insulators to the total height above the ground. In order to determine the degree of soundness existing in the present practice with regard to the choice of base width, the investigators decided to make an original design investigation of the effect on the weight of the towers produced by varying the base width and at the same time varying the design specifications and the assumption with respect to the compressive value of diagonals. This article presents a detailed account of their experiences in this research.—*Canadian Engineer*, Aug. 17, 1926.

Cooling Methods for Transformers. —C. ALBRECHT. — The heat losses in large power transformers may be dissipated by various means, according to size, local conditions and, to some extent, the choice of the customer. The author describes in this paper the available standard cooling methods in use by a large German firm. If the output of the machine does not exceed 7,500 kva. at 50 kv., self-cooling with deeply corrugated tanks is employed. For somewhat higher capacities the heat dissipation of such a tank can be enhanced by directing an air blast at the corrugations. For still greater output an enforced oil circulation is added to the air blast. For very large machines —in fact, for all transformers without an upper limit—several varieties of water cooling are recommended. The simplest method is a lead cooling coil installed in the transformer tank itself. (American practice abandoned lead cooling coils about fifteen years ago, because lead is a dangerous catalyzer of oil.) In other cases it may be found more advantageous to place the cooling coil outside the tank and to provide enforced oil circulation. A relative-cost comparison of these methods is given in the article as well as a large tabulation showing the zone of usefulness of all the cooling methods that are mentioned. — *Siemens Zeitschrift*, July, 1926.

Laying the Anglo-Belgian Cable.—About 55 miles in length, this cable weighs approximately 26 tons to the mile and carries 28 wires in pairs. On the English side the shore end was landed at Dumpton Gap, near Broadstairs, and the Belgian end at Lapamme, quite close to the French frontier. In addition to its being the second of its type in existence, the Anglo-Belgian cable has a much greater capacity than its forerunner, the Anglo-Dutch, and therefore marks a great step forward in the industry. The major task of the cable laying was handled from the old *Faraday*, a vessel with more than 50 years' service

and probably the best-known cable-laying ship in the world.—*Electrician* (*England*), Aug. 27, 1926.

Units, Measurements and Instruments

Voltage Harmonics.—In the first part of the paper the author summarizes the results of experiments on an alternating-current fan motor with a power factor of 51 per cent. When a capacity of a value calculated to increase the power factor to unity was connected in parallel and the supply was taken from an alternator of fairly good wave form, the power factor was raised to 81½. On another alternator it was 74. It was found that by connecting a three-phase balanced non-inductive load of a certain capacity the wave form could be modified to give a power factor of 99. There are in practical use many alternators, especially salient-pole machines, the voltage waves of which contain harmonics. The author accordingly undertakes an analytical survey of the problem, showing, under the specified conditions, the improvement in power factor possible with the third and twenty-fifth harmonics of different amplitudes. In the next section of the paper the author considers the effect of the power factor upon the cost of electricity to a consumer.—*Electrician* (*England*), Aug. 27, 1926.

Depth Indicator for Ships.—A. CURCHOD.—At the spring electrical exposition in Paris a new model of an automatic device to indicate the depth of sea over which a vessel sails was demonstrated. The apparatus is based upon the fact that the depth is proportional to the time interval which elapses between the sending of an electric wave and the reception of the same wave reflected by the bottom of the sea. A short-wave oscillator sends out the pilot wave by means of a quartz condenser installed near the keel of the ship. A loop and vacuum-tube detector receives the wave echo. The sent and received wave impulses are made visible on a special oscillograph along a scale calibrated directly in meters of depth. The instrument is a small self-contained unit with a depth range of 4 m. to 360 m. Its accuracy is guaranteed within one meter.—*Revue Générale de l'Electricité*, July 17, 1926.

Illumination

Heterochromatic Photometry; Critical Tests of the Ives Standardized Method. — A. H. TAYLOR. — An experienced photometric observer finds little difficulty in comparing lights of moderate color difference. However, when large color differences are encountered, such as red, green or blue against white lights, the ordinary methods of photometry are generally unsatisfactory and the experimental errors become very large. There are three general methods available for evaluating colored lights in terms of standardized incandescent lamps: (1) The lights may be compared in juxtaposed fields by the use of some type of "direct-comparison" photometer, which may be the quality-of-brightness or the contrast type. (2) A spectral analysis of the radiation from each lamp can be made by means of a spectrophotometer, and relative luminosities may then be compared by use of spectral visibility data. (3) Some method of flicker photometry may be used. The validity of the results obtained by this method, which is the most convenient available, is discussed in this paper by the author, who recently had an opportunity to apply this test to results obtained by use of the flicker photometer employed under the conditions proposed by H. E. Ives. Judging by the results described in his paper, the author expresses a belief that the flicker type of photometer used under the conditions prescribed by Ives gives results which are sufficiently reliable for all practical purposes. It requires little or no experience for its use and furnishes a very practical method of heterochromatic photometry greatly superior to any other. — *Transactions of Illuminating Engineering Society*, September, 1926.

Lighting Service. — This manual is designed to give information concerning the proper organization and operation of a central-station lighting service department. It is hoped that those companies having no lighting service department will find information here that will encourage them to establish one. For those companies already engaged in lighting activities the manual gives lighting department methods that have been proved successful. The manual, when complete, will consist of eight sections, the first five of which are published at this time. The "Lighting Field" section of the manual is to show the importance of the lighting load to the electric service company, the income derived from it, the possibilities of expansion and the good will obtained by the operation of an aggressive lighting service department. The section on "Organization" presents charts showing the organization for companies of different types and sizes. Suggestions are given relative to the selection and training of the personnel. The "Activities" section includes suggestions for general work, the securing of prospect lists and the planning of yearly activities. Under "Equipment" information on the necessary office, photometric, drafting room, demonstration and salesmen's equipment is given. A list of desirable books, catalogs and other publications is included. The "Engineering" section gives methods for the preparation of lighting layouts, illumination tests, approval of lighting equipment, and the compilation of material for publicity purposes.—*N.E.L.A. Publication No.* 267-1, August, 1926.

Motors and Control

Trend in Design of Motor Control for the Machine Tool Industry. — C. C. RUNNER. — This article deals briefly with the history of motor application to machine tools, types and location of control, direct-current and alternating-current starters for such equipment, advantages of designing machine tools to driving equipment, and motor and control as a complete working unit.—*General Electric Review*, September, 1926.

Electrophysics, Electrochemistry and Batteries

Computation of the Behavior of Electric Filters Under Load.—A. E. KENNELLY and ARTHUR SLEPIAN.—In the quantitative discussion of the behavior of an alternating-current electric filter under variable impressed frequency it has commonly been assumed that the load at the receiving end has an impedance equal to the characteristic or surge impedance of the filter; in other words, that it behaves as though the load at the receiving end was an indefinite prolongation of the same filter. The authors propose in this paper to consider a case of a simple, uniform, low-pass, five section filter, with a constant load at the receiving end, and to indicate that in the case of such a relatively high degree of complexity the behavior of the filter can be readily computed on the principle of simple alternating-current artificial lines. The results have been obtained by calculation only, as the assumed filter was not actually tested or constructed. According to the authors of the paper a sufficient number of observations have, however, been collected upon actual filters of the same type to justify reporting the computations arrived at. The method here indicated in the paper is recommended as of general and convenient application.—*Publication from the Harvard Engineering School, No.* 3, 1925-1926.

Traction

New Electric Locomotive for Brazil. —This article deals with the acceptance of a British manufacturer's design for railway equipment constructed in Great Britain and sold to Brazil. Electrification of the main line of the Paulista Railway of Brazil has been proceeding since 1921. The new Metrovick electric locomotive is the most powerful yet constructed in Great Britain. It has six motors totaling 2,340 hp. and weighs 100 tons. It will haul a 400-ton train at 50 miles an hour on the level, at 48 miles per hour up a gradient of 1 per cent and at 39 miles an hour up a gradient of 2 per cent, which, it may be mentioned, is considerably steeper than the grades ordinarily encountered on British main-line systems. Constructional details of this locomotive are given by the author as well as a discussion of the main control gear.—*Electrician* (*England*), Sept. 3, 1926.

Miscellaneous

Engineering Education—Its History and Prospects.—HENRY H. HENLINE.—A brief history of the development of engineering education in the United States and a consideration of the usual type of curriculum in particular branches of engineering are followed by reasons for the development of a new type of curriculum and a discussion of its principal characteristics. The ideals discussed in the paper are emphasized by a few selected quotations from statements of leading executives and teachers. — *Journal of A.I.E.E.*, September, 1926.

New Books

Rewinding Small Motors

By D. H. Braymer and A. C. Roe. New York: McGraw-Hill Book Company, Inc. 247 pages, 210 illustrations. Price, $2.50.

The authors have compiled in this book details of all types of windings used for portable drills, grinders, automobile-starting motors, sewing-machine motors, fans, vacuum-cleaner and washing-machine motors and other similar applications of small direct-current and alternating-current motors. The information is arranged in step-by-step details from the start to the finish of a winding job so as to make it easy for the experienced winder to understand the procedure and give him a grasp of the essential requirements of the windings that are used by the manufacturers of small motors and to enable him to rewind or change them as conditions require, even though he may not have had much experience in rewinding small motors. As armature winding calls for a combination of skill, care and common sense, together with a practical knowledge of motor construction and operation, this volume should have a real value to men who are concerned with fractional-horsepower motors.

Wirkungsweise der Motorzähler und Messwandler

By Dr.-Ing. J. A. Möllinger. Berlin: Julius Springer. 238 pages, 131 illustrations.

By confining himself to a discussion of principles of operation, without attempting to include details of mechanical construction, the author has been able to devote adequate space to the theory of the numerous types of meters in commercial use without exceeding the limits of a compact volume. The treatment is analytical, in the sense that vector diagrams and equations are used where necessary, but it is mathematically simple. The viewpoint is that of the practical engineer, not the theorist; the title page indicates that the author is director of the meter works of one of the leading German electrical manufacturing firms.

Consideration of the underlying theory leads naturally to analysis of sources of error, whether inherent or due to misconnections and methods of calibration. The first few chapters deal with the direct-current dynamometer-type watt-hour meter and with the ampere-hour meter. The major portion of the book is, however, devoted to alternating-current meters. Reactive metering comes in for considerable attention, first as to its economic justification and then as to the practical methods employed. This matter of the economics of various schemes of charging for electric service so as to take account both of the investment in plant and of actual energy consumption is, in fact, a troublesome one and has led to a variety of metering schemes, which the author reviews. One of these employs a "mixed energy" meter, which can be set to add up the kilowatt-hours plus a certain fraction—for example, 10 per cent—of the reactive kva. Another device is the ball-type kilowatt-ampere meter, on which American technical literature has thus far been rather scanty. The last 51 pages are devoted to instrument transformers, alone and in conjunction with meters. Commendable features are the clearness of the line cuts, the complete absence of "padding" by catalog illustrations, the clear and authoritative treatment of the subject and the excellence of the book as a mechanical product. On the negative side may be noted the absence of any reference to the mercury type of meter, which may mean simply that the latter has not been widely adopted abroad, and the lack of an alphabetical index, though that omission is made up in a large measure by an adequate table of contents and a systematic treatment based on it. G. F. W.

Business Annals

By Willard L. Thorp and Wesley C. Mitchell. New York: National Bureau of Economic Research, Inc. 380 pages. Price, $4.

No phase of business activities possesses more real interest to the executive and student of industrial operations than the study of the recurring "ups" and "downs" of business and industry, or what has come to be commonly known as the "business cycle." Its probable duration and degree of prosperity and depression, if they could be foretold, would take much of the uncertainty out of business operations as they exist today. The comprehensive study of this subject, therefore, which has been made by Willard L. Thorp and just released by the National Bureau of Economic Research is a most welcome contribution to the science of modern business.

"Business Annals" is an attempt to summarize and depict business conditions in seventeen countries as they appeared to intelligent and expert observers. The tables and yearly business and economic analyses run back through a considerable period, those pertaining to the United States and England extending back yearly to 1790. Each year of this extended period is summarized as to economic conditions—industrial, commercial, labor, money, security, foreign exchange, agricultural production and prices—and is also reviewed as to various non-economic phenomena which may have exerted an influence upon the conditions of business.

This record of business conditions has been made especially valuable and attractive to the general reader by the inclusion of a chapter written by Wesley C. Mitchell explaining and interpreting the basic record in considerable detail. The cyclic character of business fluctuation and the duration of these business cycles is thoroughly discussed. Counting the business cycles as the intervals between recessions, the author notes 32 business cycles in the United States in 127 years, which yields an average length of not quite four years. The interesting fact is brought out that American business cycles have a shorter average duration than those of any other country studied.

Principles Underlying the Design of Electrical Machinery

By W. I. Slichter. New York: John Wiley & Sons, Inc. 312 pages, illustrated.

Seven years' service in the design department of a large manufacturing company, sixteen years' teaching of design and the fact that this experience has been coupled with almost continuous active contact with the country's best electrical engineers through A.I.E.E. conventions and committee meetings, affording a constantly developing and fresh perspective, speak eloquently for Professor Slichter's qualifications to discuss the subject he has selected.

No author would be bold enough to claim that he has completely covered a subject in one volume. It should, therefore, suffice to say that the information which is most fundamental to electrical design is contained in this book. Students of design and even practicing designers will undoubtedly appreciate its combination of good points found separately in other books on design in that the derivation of formulas from fundamental theory, physical meanings of constants and a systematic procedure for calculating designs are incorporated in one book. This combination enables the student to tie together theory and practice and helps the designer to avoid misapplying formulas which, with developments in the art, may now have limited application. Because of the many changes that time brings it does seem that an author might well introduce different sections of a book on design with brief comments on how the developments of the last few years are changing the relative importance of certain design features.

Books Received

Costruzioni Elettromeccaniche. By Ettore Morelli. Turin, Italy: Unione Tip-Editrice Torinese. 1232 pages, illustrated. 60 lire.

Uber Zerstörungs- und Alterungserscheinungen an Parzellanisolatoren. By Dr.-Ing. K. Draeger. Berlin: Julius Springer. 36 pages, illustrated. Price, 2.40 reichsmarks.

Dielektrisches Material. By Dr.-Ing. A. Bültemann. Berlin: Julius Springer. 160 page. Price, 10.50 reichsmarks; bound, 12 reichsmarks.

Chemistry in the Word's Work. By Harrison Hows. New York: D. Van Nostrand & Company. 244 pages, illustrated. Price, $3.

Electrical Machine Design. By Alexander Gray, revised by P. M. Lincoln. New York: McGraw-Hill Book Company, Inc. 523 pages, illustrated. Price, $5.

Transmission Line Theory and Some Related Topics. By William S. Franklin and Fredrick E. Terman: Lancaster, Pa.: Franklin & Charles. Illustrated, 312 pages.

Theoretical and Practical Electrical Engineering. Vols. 1 and 2. Washington, D. C.: The Bliss Electrical School, Vol. 1, 735 pages; Vol. 2, 730 pages; illustrated.

Elements of Heat Power Engineering. By William N. Barnard, Frank O. Ellenwood and Clarence F. Hirshfield. New York: John Wiley & Son, Inc. 493 pages, illustrated. Price, $4.50.

The Religion of an Electrical Engineer. By George D. Shepardson. New York: Fleming H. Revell Company. 186 pages.

Die Elektrischen Maschinen. By M. Liwschitz. Leipzig: B. G. Teubner. 336 pages, illustrated. Price, bound, 14 reichsmarks.

News of the Industry

Experimental Arch Dam Holds at 60 Ft.

Has Thickness of 7½ Ft. at Bottom, Tapering to 2 Ft. at Half-Way Level and Thence Maintaining That Dimension—Structure Will Be Raised to Perhaps 100 Ft.

WHEN the 60-ft. experimental dam built under the auspices of the Engineering Foundation on Stevenson Creek in Fresno County, Cal., failed to break when filled to overflowing on Sept. 18, another milestone was passed in the field of research engineering. Reports on this large-scale experiment have been watched very carefully throughout the civilized world, for it is the first thorough effort ever made really to determine the breaking point of the arch dam. This experimental dam is but 7½ ft. thick at the bottom, gradually tapering until it is but 2 ft. thick at the 30-ft. level. Above that level the 2-ft. thickness is maintained throughout. The dam measures 140 ft. along the crest, is 60 ft. high, and the arch has a radius of 100 ft. No reinforcing material was used.

Preliminary work on this dam was begun in the fall of 1925. Excavations were made to make the base line of the dam as nearly a perfect V as was practicable in order to have a symmetrical cross-section which would permit of subsequent analysis with a minimum of complications. Pouring of concrete was begun on April 19 and was completed June 4. In laying the lines of the dam and in constructing the forms for pouring the concrete great care was exercised so that the structure would conform as closely as possible to the plans. The average strength of the concrete was slightly over 2,000 lb. per square inch at 28 days and showed a high degree of uniformity. Thirteen load tests were made, the first on July 12, the last on Sept. 22 and 23. During these tests careful watch was kept for possible leakage.

With a head of less than 50 ft. no leakage through the concrete of the dam or through any of the construction joints developed, although there was a slight leakage around the ends of the dam. When the head was raised to 50 ft. a small patch of moisture about twice the size of a man's hand appeared at a construction joint about 15 ft. above the base of the dam. When the maximum head of 60 ft. was reached a moist area approximately 7 ft. high and 7 ft. long appeared at a construction joint about 20 ft. from the base of the dam. Smaller seepages were apparent at a construction joint at the 55-ft. level also, but these were insignificant. No attempts at waterproofing the structure had been made other than careful grading of the aggregate 55 ft. so as to give a dense concrete. Some leakage occurred around the abutments.

Exceedingly accurate measurements were made of strain and deflection and testing, and the committee reports that it is highly pleased with the results which have thus far been obtained. It is expected that a full and complete report will be prepared as soon as practicable in which all results will be tabulated. Approximately $100,000 has been spent upon the dam to date. This money was contributed by public-spirited organizations throughout America, representing manufacturers, investment bankers, engineers, engineering schools and public utilities. Hope is held by those sponsoring the experiment that funds will be available for the raising of the dam until it finally gives way, even though it be required to raise the structure to the 100-ft. level.

H. W. Dennis, chief civil engineer of the Southern California Edison Company, was in full charge of the actual construction work on the dam. W. A. Slater, chief of division of concrete and masonry structures of the United States Bureau of Standards, has had charge of the securing of the test data.

Interprovincial Agreement for Carillon Development

Following a conference with Premier Ferguson of Ontario and representatives of the Ontario Hydro-Electric Power Commission held on Oct. 4 in the city of Quebec, Premier Taschereau of Quebec Province announced that Ontario and Quebec had come to a complete agreement regarding the terms under which Carillon Falls on the Ottawa River would be developed. He said that the two provinces were in perfect accord on the contract, which is to be signed with the National Hydro-Electric Company. From what can be learned, the development of Carillon Falls will be started without delay. The National Hydro-Electric Company, which is headed by Henry Miles, already possesses rights as regards the leasing of the site.

The whole falls will probably be leased at about $25,000 a year for 75 years. In addition, the company undertaking the development will have to pay 50 cents a horsepower on half of the power available, which will mean an average of $75,000 per year. Owing to the fact that Ontario will have a share in the power, no export tax will be charged when power is transmitted to the Province of Quebec; but a clause forbidding the exportation of power to the United States, in accordance with the Taschereau policy, will be inserted in the contract.

As to how the development will be carried out by the private interests concerned, information is that the Aldred-Shawinigan group is looking after the necessary arrangements and will also dispose of the power when it is developed. These interests will have as their first client the Ontario Hydro-Electric Power Commission for more than 100,000 hp. In addition, they will be at liberty to handle the demand from the Montreal district.

Water Hearing Postponed

Opponents of Salmon River Regulation See Politics in Course Taken by New York Board

INDEFINITE postponement of a hearing scheduled for Oct. 5 on the application for creation of the Salmon River Regulating District, a proposal which would create further hydro-electric power resources in the Adirondacks, was announced from Albany this week on behalf of the State Water Control Commission. Opponents of the proposal, who include members of the Association for the Protection of the Adirondacks, the Adirondack Property Owners' Association and the Saranac Lake Chamber of Commerce, were on their way to Albany when the decision to postpone the hearing was announced. Their attorney, Jacob G. Schurman, Jr., who denounces the application as intended to promote "a power grab pure and simple," expressed resentment at the postponement of the hearing. This is attributed to a desire to keep the matter from involvement in the political campaign.

To show what they contend is the stake of the power interests in the petition its opponents have compiled the following table of created or proposed river-regulating districts in the Adirondacks:

REGULATION AND POWER IN ADIRONDACKS AS OPPONENTS SEE IT

River	Acres of State Land Involved	Primary Horsepower Before Regulation	Primary Horsepower After Regulation
Black.....	5,400	45,000	184,000
Hudson.....	12,466	64,000	247,000
Raquette.....	6,700	25,500	238,500
Salmon.....	1,200	3,000	15,000
Saranac.....	4,500	12,000	36,500
St. Regis.....	100	16,000	58,500
Oswegatchie..	None	7,000	52,000
Aussable.....	352	5,500	15,500
Total.....	30,718	178,000	847,000

"It is conservatively estimated," reads a statement issued by the organizations opposing the creation of the Salmon River regulating district, "that the water rights on these rivers controlled by the Northeastern Power Company, of which the Malone Light & Power Company [applicant in the Salmon River petition] is a subsidiary, and its affiliated interests will be increased in value by these storage reservoirs constructed under the conservation act with the land, services and credit of the state to the extent of $50,000,000."

In the Hurricane's Wake

How the Alabama Power Company Tackled the Task of Restoring Service in Pensacola and Mobile

AMONG the first to enter the storm-stricken area around Mobile, Ala., and Pensacola, Fla., after the recent hurricane had abated were the construction crews of the Dixie Construction Company, building organization of the Alabama Power Company. Fortunately, at that time there were eleven construction camps between Flomaton, Ala., 35 miles north of Pensacola, and the two storm-swept cities. The official account of how the men trudged and swam and battled their way through the wreckage of the storm is contained in a report made by A. C. Polk, construction manager of the company, who went from Birmingham to Pensacola to take charge of the situation. He says in part:

"On Monday morning the company shipped from Birmingham equipment sufficient to house 300 men, sending it to Flomaton and Mobile. On Monday afternoon Construction Manager Polk, General Superintendent Weiss and Field Superintendents White and Smith, with chief material men and assistants, started for the southern part of the state. On Monday also all lines and communications with this territory were suddenly cut off by the arrival of the hurricane. Trains on that night ran only to Montgomery, but with the co-operation of the railroad officials the company succeeded in carrying these men and others as far south as Brewton. South of Brewton the railroad bed was washed out, and travel by automobile, truck or tractor was impossible.

"Two of the Dixie superintendents were started to Flomaton, 15 or 20 miles away, on foot and struggled through to their destination in one day with the help of the people along the way, who furnished them with a lift wherever the road was passable for any sort of conveyance. The rest of the way they walked or swam. They reached Flomaton that night after a very difficult and dangerous trip. The manager and general superintendent went back to Montgomery in the hope that they would get through from there by automobile, but on later advices Tuesday they returned to Brewton and managed to get through to Flomaton that day. Two other men went around by Selma and managed to push their way through from there, arriving at Mobile on Tuesday.

"The next problem then was to get into Pensacola. A reconnaissance was made of the highway from Flomaton to Pensacola, and it developed that it was badly washed out in three places and the water still very high. A Dixie force of 50 men was immediately set to work to build temporary bridges over these washouts so that camp equipment and heavy trucks could be moved in to start work on restoring service in Pensacola. Polk and Weiss managed to push on, crossing the washouts by walking and swimming through the water, arriving at Pensacola late Tuesday. A survey of conditions was then made and a plan of action mapped out. Tuesday afternoon late forces with light tools were brought through ahead of the completion of the bridges. By Wednesday morning a large force was at work, the bridges and washouts having been repaired.

"By Thursday morning sufficient repairs had been made to the power house to start one machine, and power was supplied to essential industries and institutions, including the waterworks, hospital, local newspaper and broadcasting station. One hundred and eighty men with trucks and materials were sent into the town, and order soon began to come out of the chaos that had existed for several days. Friday the business section of the town was lighted. In spite of the fact that all camps and their food supplies had been destroyed and all transportation facilities wrecked or blocked, this whole program of aid to Pensacola was functioning 48 hours after the storm had subsided.

"At Mobile the call for aid went out to the various construction camps of the Dixie Construction Company. Division Foreman Perry started out of Gulfport with 20 men in a 2½-ton truck on Monday morning in the teeth of the gale. He reached Pascagoula, but there the ferryman refused to let his boat cross the river in such a storm. He then went back up the river 40 miles, found a ferry which was willing to cross the stream, and he and his men, truck and supplies crossed. By chopping trees off the roads and fighting the storm all night they finally reached Mobile Tuesday by bringing the truck over the cross-ties and trestles of the railroad. From other camps the men got out by swimming, tramping through the swamps to their waists and cutting their way through the fallen timber in the woods, reaching Mobile on Tuesday night. These men had already suffered great hardships and dangers, but when the call came they forgot themselves and remembered only that their job was one of service to the public."

Empire State Association at Lake Placid

Attractive Plant Exteriors, Systematic Promotion of Rural Extensions, Better Highway Lighting and Other Progressive Policies Are Indorsed

ADDRESSING the opening session of the twenty-second annual convention of the Empire State Gas and Electric Association, at the Lake Placid Club, Lake Placid, N. Y., on Monday, Oct. 4, President Ernest C. Scobell dwelt on the growth of the electrical and gas industries, the tendency to their consolidation under large holding organizations, the advantages and weak spots of commission regulation and the need for further effort to make buildings and plants attractive structures architecturally and esthetically. On the last point he observed that there was "no earthly reason" why a power plant or even a gas plant should be "downright ugly."

The report of the farm service committee was presented by its chairman, Charles S. Ruffner, president of the Adirondack Power & Light Corporation, who put forth a picture of the situation covering approximately 75 per cent of the total area of the state outside of New York City. From reports of eighteen power companies it appeared, he said, that farmers and others are already receiving electric service from 7,411 miles of distribution lines in rural areas, representing an investment by the companies of more than $13,500,000. Two phases of the general problem suggested themselves for consideration—first, how to increase the usefulness of service that is now available and, second, how to hasten the time when rural electric service will be generally available. Under the guidance of the committee, a farm electrification research council, a women's committee on electricity in the farm home and a farm business committee had been organized. The research council consists of rural engineering specialists from the College of Agriculture at Ithaca, of representatives from the leading manufacturing concerns and of agricultural engineers from the power companies. This group conducts tests and experiments in connection with the application of electrical machines and devices to various farm problems. The women's committee carries on work with particular reference to problems of the home, and the farm business committee is made up of commercial executives from the power companies. All three groups are working to good result.

HIGHWAY LIGHTING

The modern lighting of all the state and county highways of New York State, paying for it out of a gasoline tax, was recommended by the committee on highway lighting, headed by Fred D. Corey, president of the Niagara, Lockport & Ontario Power Company. His report was read by C. A. Volz of the Niagara Falls Power Company. The committee found that only 500 of the 9,000 miles of main highways outside of the suburban communities are adequately lighted. It said that the power lines for such lighting are available in the great network connecting the various power systems of the state. The amount of tax suggested is 2 cents a gallon, which is expected to provide about $15,000,000 a year.

Samuel S. Board, director of the Yale Graduate Placement Bureau, made an address on the selection and training of utility company employees, and Charles R. Vanneman, chief engineer of the Public Service Commission, urged that the power companies in all sections of the state should adopt uniform forms of rates reduced to the simplest possible basis so that a customer removing from one part of the state to another will find the system of charging virtually the same as that to which he is accustomed.

On Tuesday M. S. Sloan, president Brooklyn Edison Company, reporting for the committee on public utility information, emphasized the need for a public relations policy and a definite public relations program for the indus-

try in the Empire State. The committee on public utility information could take the lead in this work, but the companies themselves must carry it out.

Mr. Sloan was followed by Theodore J. Grayson, associate professor of finance at the University of Pennsylvania, who read a thoughtful paper on "Management Problems of the Holding Company." Miss Helen Smith, industrial engineer with the Rochester Gas & Electric Company, was another contributor to the program, her remarks dealing with the sale of appliances to women, with some criticism of certain methods of "high-pressure sales."

The attendance at the convention, 275, was the largest ever registered by this association. A program of entertainment, a golf tournament and the annual banquet and president's reception and dance added to the interest. New officers were elected as follows: President, H. M. Brundage, vice-president Consolidated Gas Company, New York; first vice-president, H. O. Palmer, vice-president Empire Gas & Electric Company, Geneva; second vice-president, C. S. Ruffner, president Adirondack Power & Light Corporation, Schenectady; treasurer, W. J. Welsh, president New York & Richmond Gas Company.

West Virginia Utilities Men Gather

Optimism for the Future of the Light and Power Industry in State and Nation Prevails at Well-Attended Convention in Charleston

THE ninth annual convention of the Public Utilities Association of West Virginia was held at the Hotel Kanawha, Charleston, W. Va., on Friday and Saturday, Oct. 1 and 2, with an attendance reaching 300. President W. R. Power, general manager of the Consolidated Power & Light Company, Huntington, in his annual address said that West Virginia now stands eighth among the states in output of electric power and with the installation of proposed equipment and the development of some of the state's potential water power would rank still higher. He called attention to the installation this year of a hydro-electric plant by the West Penn company at the state line in Monongalia County with a capacity of over 60,000 kva. and the addition of a 65,000-kva. turbine by the Appalachian Electric Power Company in the southern part of the state. Transmission lines have been built throughout the state, connecting with those in neighboring commonwealths, he said, but at present many millions more kilowatt-hours are being exported than are being imported.

Other addresses at the first day's session were by George M. Chute, Jr., of the General Electric Company, who spoke on "Recent Developments in the Use of Synchronous Motors in Industry;" D. L. Gaskill of Greenville, Ohio, secretary of the East Central Division of the National Electric Light Association, who spoke on "Public Relations, a Liability or an Asset," and former Governor E. F. Morgan, whose subject was "Citizenship."

Miss Helen E. Steiner of Cleveland, chairman of the women's committee of the East Central Division, N.E.L.A., proved an able representative of the movement to give a larger share of responsibility for good public relations to members of her sex. "The public," Miss Steiner said, "will generally reach a fair conclusion if it knows the facts upon which to base its impressions, and the only way it can know these facts is for utility people—and that means women as well as men—to tell it these facts."

Besides those already named, participants in the two days' meetings were Thomas D. Mays, who spoke as a professional advertising man; A. M. Hill, representing the transportation interests; N. M. Argabrite, vice-president Appalachian Electric Power Company, who told of "West Virginia's Place in the Eastern Power District"; A. J. Darrah of the same company's Logan office, whose topic was "Open-House Week"; C. H. Hardesty, manager of the Monongahela West Penn Public Service Company at Parkersburg, who spoke on "Value of Educational Courses for Employees," and Prof. A. A. Hall of the West Virginia University, Morgantown, who told of the meter courses held at that institution.

A Successful Banquet

Optimism was the keynote of the banquet on Friday night, at which former Governor W. A. MacCorkle of Charleston was toastmaster and H. B. Flowers, president of the New Orleans Public Service Company, the chief speaker. Leaders in the utility industry from every section of the state were present, and besides Mr. Flowers, State Senator W. R. King of Virginia and J. J. Divine of the West Virginia Public Service Commission spoke.

Mr. Flowers quoted Viscount Rothemere, the noted British publisher, and Lewis E. Pierson, chairman of the board of the Irving Bank-Columbia Trust Company, New York, to prove his statement that the economical welfare of the United States is based more than anything else upon the fact that we have 29,000,000 hp. of electrical energy established in our factories, a force equivalent to 290,000,000 human workers. "The electrical industry *is* truly the backbone of the nation's industrial structure and progress," Mr. Flowers said. "It is so interwoven with the progress of the nation that national, civic, social and industrial problems hinge on the power and growth of electrical output and accomplishments. That gives us a tremendous responsibility."

J. D. Whittemore of Fairmont, vice-president of the Monongahela West Penn Public Service Company, was elected president of the association for the coming term. Other officers elected were: Vice-presidents, A. M. Hill of Charleston, C. S. Dawson of Charleston and A. C. Spurr of Wheeling; secretary (re-elected), A. Bliss McCrum, Charleston; treasurer, G. B. Moir, Charleston.

Cleveland Meeting of A.E.R.A. Draws Great Throng

With an initial registration of 5,679, the forty-fifth convention of the American Electric Railway Association at Cleveland this week broke all attendance records. The proceedings were overcast by the sudden death on Monday evening of John J. Stanley, president of the Cleveland Railway and leading promoter of this year's convention. Mr. Stanley's death is noted and his career briefly referred to elsewhere in this issue. The untoward event led to the elimination of all entertainment features, but the business sessions of the convention went forward according to the prepared program. The Charles A. Coffin annual award went to the Pennsylvania-Ohio Electric Company of Youngstown, Ohio. New officers were elected as follows: President, W. H. Sawyer, president East St. Louis & Suburban Railway Company; first vice-president, R. P. Stevens, president of the Republic Railway & Light Company, New York; second vice-president, James P. Barnes, president Louisville Railway Company; third vice-president, Paul Shoup, president Pacific Electric Railway Company, San Francisco; fourth vice-president, J. E. Hanna, president Capital Traction Company, Washington, D. C.

Florida Power & Light Reports Rapid Restoration

S. R. Inch, president of the Florida Power & Light Company, reports by wire from Miami that the company's kilowatt-hour output in the storm area is now 70 per cent and the peak 55 per cent of what it was prior to the hurricane. All generating stations are operating, Mr. Inch says. The gas, water, ice and bus business of the company and its subsidiaries was completely restorted within 48 hours after the recent storm. The electric railway service in Miami has now been completely restored and that at Miami Beach will be restored within a week. The total loss to the buildings of the company is almost negligible.

Very few electric transmission and distribution poles of the company in the storm area on the east coast were broken or otherwise damaged, Mr. Inch reports, although many poles were blown over. Of the lines so affected, 70 per cent of the transmission and 40 per cent of the distribution lines have been completely restored and are now in operation. By Saturday last 60 per cent of the company's electric power and light customers in the storm area on the east coast were receiving regular service. The company's service in the storm area on the west coast has been practically 100 per cent at all times since the hurricane.

Employees of the Florida Power & Light Company and those of the Phoenix Construction Company, which is building large new power plants and extensions to properties of the Florida Power & Light Company, have been working on a twelve-hour schedule making repairs and restoring service, but they have now been placed on a ten-hour schedule and next week should be back on an eight-hour schedule.

Hydro Sites in Manitoba

Rival Paper Manufacturers Compete for Rights in That Province and Western Ontario

THE recent contract entered into by the city of Winnipeg with the Manitoba Power Company for the purchase of $4,725,000 worth of energy, to be delivered to the civic hydro project over a period of ten years, is, Ontario advices say, only a small part of the great power development program that is in store for eastern Manitoba and western Ontario during the next decade. Commercial interests of the United States, the United Kingdom and the Dominion are competing for control of the pulpwood and hydro-electric sites between Fort William and Winnipeg. In the huge economic struggle the water power and the material for manufacturing white paper are classed as one. Ontario controls these two great assets, but in Manitoba the natural resources are still administered by the federal government.

At Fort Alexandra, in Manitoba, 100 miles northeast of Winnipeg, near the Ontario border, the McArthur Pulp and Paper Corporation is just completing a 200-ton mill. The company's concession gives it the primary selection over a timber limit of a thousand square miles for a long period. Associated with the McArthur syndicate are the powerful Spanish River Corporation and allied interests. At St. Boniface, across the Red River from Winnipeg, the Seamans of Chicago, closely allied with New York and Boston capitalists, are negotiating for a 100-ton mill site. Its erection depends somewhat on the terms that can be made with the federal government for a timber limit. Around St. Francis and International Falls the Backus-Brooks Company and the Shelvin-Clark interests are in lively competition.

These aggressive combinations of capital are likely to be active rivals at Ottawa during the next session of Parliament for timber limits and water-power sites along the streams flowing into the Lake of the Woods and Lakes Manitoba and Winnipeg. For a thousand miles north of Winnipeg the engineers of these conflicting interests are surveying hydro sites and timber limits. They are virtually the only people who know the extent and economic value of the country.

In the race for these assets appears the Manitoba Power Company, representing another set of influential moneyed men, chiefly from Toronto, Montreal, Winnipeg and New York. The interlocking connections give them great advantages in the race to control the valuable power sites and timber of the vast territory being exploited. Their plans contemplate very large expenditures in that section during the next ten or fifteen years.

Addressing a meeting in Winnipeg recently, A. W. McLimont, vice-president Winnipeg Electric Company, said that plans were being developed for another power plant of greater capacity than any of those at present serving Winnipeg and at a site sufficiently close to that city to permit of the economic transmission of power. Mr. McLimont referred to the Great Falls power site and predicted that within four years every horsepower producible at that plant would be sold.

Kansas Rural Electrical Laboratory Gets Results

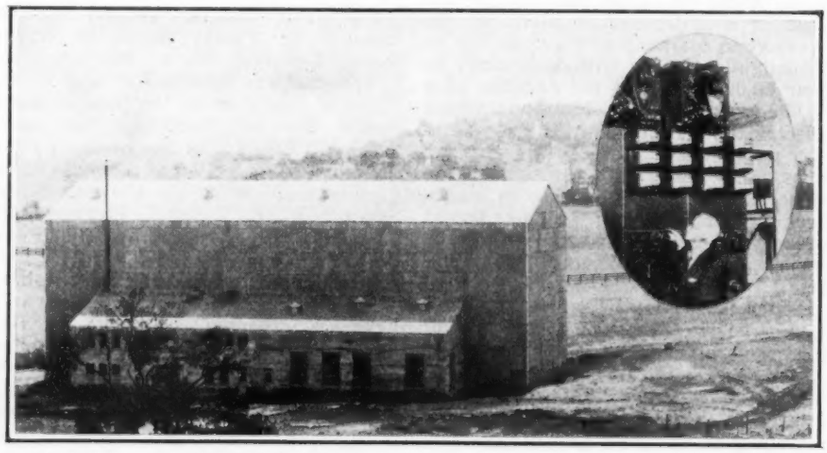
Visual evidence of what electricity actually can do for Kansas agriculture was put before the people of that state on Sept. 29, when the Kansas Rural Electrical Laboratory, comprising nine Pawnee County farms, was thrown open to public inspection. Established near Larned in September, 1925, this electrical laboratory has been conducting for the last ten months an intensive study of the practical application of electrical energy to farm requirements. The experiments have been under the direct supervision of the agricultural and engineering experiment stations of the Kansas State Agricultural College, Manhattan, and form part of the work of the Kansas Committee on the Relation of Electricity to Agriculture.

Farmers, farm organization leaders, engineers, educators, electric light and power company executives, farm journal and newspaper editors and representatives, equipment manufacturers, business men and others participated in the field-day tour of inspection of the nine experimental farm projects. Most of the electrical installations on the nine farms are of the farmers' own selection, and many of them were in use before the electrical laboratory was chosen. Almost every type of farm activity—live-stock raising, dairying, grain farming, sugar beet and alfalfa growing, poultry raising and forage production—is represented by the farms being studied, and almost every electric appliance manufactured for domestic use is to be found in the homes embraced by the experiment. As many as eight separate meters have been placed on the meter boards in the basements, affording a reliable index to the cost entailed by individual pieces of equipment.

Among striking facts established by the studies are that 5,000 sheep can be watered by an automatic electrically driven pump at a daily cost of 5 cents; that 20 cows can be electrically milked at a cost of $1.80 per month; that it costs less than 3 cents to wash 1,000 milk bottles; that 10,619 kw.-hr. of electricity will pump 136 acre-feet of irrigation water to 50 acres of sugar beets; that an electric grain blower can "shovel" 1,300 bushels of newly harvested wheat into a bin at a total cost of 78 cents, and that wheat can be elevated a vertical distance of 34 feet at a cost of one cent for each 40 bushels.

The experimental investigations are being financed by the light and power companies of the state. Energy is supplied to the Larned district by the United Power & Light Corporation, Abilene.

New Electrical Laboratory of Stanford University



ABOVE is shown a view of the new electrical laboratory erected by Leland Stanford University at Palo Alto, Cal., where, as recounted Sept. 25, six transformers of General Electric make with a total rating of 2,100,000 volts have just been installed. To the right of this illustration Prof. Harris J. Ryan is shown at the laboratory switchboard. The new building has a steel framework covered with asbestos. The main building is 173 ft. long, 60 ft. wide and 65 ft. high. It has an interior height of 50 ft. in the clear to the roof trusses, with no supporting columns.

For some experiments the building can be made light-proof, not a ray of sunshine penetrating to its vast interior. For other uses virtually one whole side can be rolled away, since three great metal doors, each 47 ft. high and 40 ft. wide, are mounted on rollers in such fashion that a single man can move them easily, opening a space 120 ft. long. The reason for these giant doors and for the great space within the building lies in the fact that safety for life and equipment requires that there be a full 20-ft. clearance everywhere about the main electrodes. A much smaller building of concrete has been built adjacent to the north side of the main building to contain the requisite power-plant and voltage control facilities, offices and instrument and photographic rooms.

A large illustration of the transformers, with a description of the main details of their construction, was printed in the ELECTRICAL WORLD for April 24 last, page 852.

Hagerstown Gets Permission to Build Municipal Plant

Permission to construct a new municipal electric light and power plant at Hagerstown, Md., was granted last week to the Mayor and Council of that city by the Public Service Commission, which also approved issuance of bonds by the municipality in the amount of $300,000 to finance the project. Protracted hearings on the application had been held during the summer, protests against sanction of the proposal and the bond issue having been filed with the commission by a group of taxpayers of Hagerstown and by the Potomac Edison Company, a competitor of the municipal plant. This company will appeal from the ruling.

It was contended that the proposed plant was not required for the public convenience because the Potomac Edison Company had available all the electrical energy that possibly could be required by the people of Hagerstown and was prepared to furnish this energy at fair and reasonable rates.

Three years ago the commission refused a similar application. The city then had special legislation passed which the courts declared unconstitutional. In reversing its former decision the commission pointed out that both the municipal plant and the Potomac Edison Company were in active operation when the commission was created and expressed the opinion that "it was clearly the intention of the General Assembly of Maryland that the Mayor and Council of Hagerstown should be permitted to build its new electric plant, that it should be permitted to render lighting and power service within the limits of the city to all such residents and industries of Hagerstown as desired to be served by the municipal plant, and that the municipal plant should be permitted to grow with the city and develop as the demand of its people for electrical energy increases."

As regards the economic contention of the protestants, the opinion said: "This commission feels that in this situation there is involved something that transcends a mere problem in economics."

Wisconsin Inspectors Have a Profitable Meeting

With a well-balanced program, the first annual convention of Wisconsin Chapter No. 1, Western Section of the International Association of Electrical Inspectors, held in Milwaukee on Sept. 27-28, went off in a manner that would have done credit to a veteran organization. Charles Hayden, service engineer of the Wisconsin Railroad Commission, outlined on the first morning the views of the commission concerning electrical inspection, urging the chapter to continue its efforts to maintain the present high standard of installations in Wisconsin. Mr. Hayden declared that the commission would stand back of any legislation to bring about better wiring and insulation. The principal speaker at the afternoon session was Leo Mullaney, assistant city attorney of Milwaukee, who believed that electrical inspectors should know more about the law within the realm of their duties than the lawyer should know about electrical inspections.

The second day opened with an excellent address on co-operation by Franklyn Mayer, chairman of the safety division of the Milwaukee Association of Commerce. Mr. Mayer was followed by William S. Boyd, Chicago, secretary of the Western Section of the I.A.E.I., whose address, entitled "Are We Destroying a Craft?" attempted to show that the passing of the electrical contractor, journeyman, wireman, and possibly the electrical inspector, seems to be at hand because of the "canned" cheap wiring which can be purchased at stores and installed by home owners regardless of engineering principles. He urged vigorous action to correct this growing evil. George Nichols, manager of the Wisconsin Inspection Bureau, Milwaukee, touched on the question of more frequent and regular inspections of old installations. Admitting that the public does not now appreciate the work of the electrical inspector, W. F. Baumann of the Theatres Advertising Company, Milwaukee, in an address at the afternoon session, offered concrete suggestions for a systematic publicity and advertising campaign of enlightenment.

Fred Gratz, electrical inspector of Madison, was elected president, and Walter Wilke, electrical inspector of Milwaukee, secretary. Consolidation of the chapter with the Wisconsin Electrical Inspectors' Association was discussed, but no definite action was taken.

Major Edgerton Inspects California Projects

California is continuing to increase its lead as the state with most developed water power, Major Glen E. Edgerton, the chief engineer of the Federal Power Commission, said on his return from a visit to several projects in that state. He was impressed with the progress being made on the large hydraulically filled dam of the Great Western Power Company at Lake Almanor, which will add 110,000 hp. to that company's output. The work is 75 per cent completed, he reports, and will be finished by the end of the year.

Major Edgerton also inspected the work being done at Bucks Creek under the license issued by the Federal Power Commission to Lars Jorgensen. The work there is progressing rapidly. The storage of water will begin next spring. The power developed at this project also will go into the Great Western system. The company is pushing development so as to meet the rapidly growing load in San Francisco.

After looking over the Trinity River situation Major Edgerton is inclined to believe that the diversion of the Trinity into the Sacramento Valley is the best use that can be made of that water. Such a plan was embodied in the project of W. H. Sampson, but he allowed his preliminary permit to expire in August. There will be little loss of power by diverting the Trinity, and it is unlikely that there will be any important agricultural development in the Trinity Valley. On the other hand, the water could be used to the greatest advantage for both power and irrigation purposes in the Sacramento Valley.

The plans of the Merteau Irrigation District, which has applied for a license after having complied with the requirements of its preliminary permit, depend somewhat on the agricultural development of the district. The irrigation district's project, which is at Augur Falls on the Snake River, contemplates the development of 15,000 hp. The use for at least one-half of the power would be in pumping water for lands which have not been developed as yet. That the site is a desirable one is indicated by the fact that the city of Twin Falls and Barry Dibble of Redlands, Cal., have filed conflicting applications. Major Edgerton was anxious to get first-hand impressions of the project before making a recommendation.

A.S.M.E. Holds Power Session at Richmond

Three papers were presented before the power session of the Richmond (Va.) regional meeting of the American Society of Mechanical Engineers on Sept. 30. The first, by Arthur Scrivenor, of Richmond, reviewed conditions found in many industrial power plants and showed how the consulting engineer can be of service by offering suggestions toward better results. The speaker made a plea for the keeping of more intelligible operating records.

A paper on "The Design of High-Pressure Industrial Power Plants," by R. S. Baynton, described the new plant of the Chesapeake Corporation at West Point, Va., where high-pressure boilers operating at 425 lb. supply a 1,500-kw. turbine exhausting at 130 lb. to a medium-pressure header. This header supplies steam for certain processes and also for two medium-pressure bleeder turbines of 750 kw. each, which furnish lower-pressure steam for other processes and run part condensing in accordance with the steam and electrical demands. With this arrangement an almost perfect heat balance is obtainable and the estimated savings over the old low-pressure plant amount to $136,500 per year. These savings will pay for the investment in less than three years. Air preheaters and three-effect evaporators are some of the refinements in the new plant.

W. C. Bell, chief engineer of the Virginia Electric & Power Company, outlined some of the power interconnections in Virginia and North Carolina and reviewed the general agreements under which interconnection exists.

The three papers evoked considerable discussion, during which the exchange of power between industrial plants and utility companies was considered from both points of view, the utility men present being generally opposed to the idea on the ground that privately generated power often could not be taken by the central station at advantageous times. Fear was expressed that it might affect the system power factor.

During the meeting it was officially made known that Charles M. Schwab had been elected president of the society for the coming year, the vice-presidents elected being Charles L. Newcomb of Holyoke, Mass.; Prof. Everett O. Eastwood of Seattle and Edwards R. Fish of St. Louis.

Purchases and Mergers

Important Consolidations in Arkansas and Oregon—Transactions in Other States in Every Section of the Country—More Municipal Plants Surrender

A NEW organization known as the Arkansas Power & Light Company has been incorporated under the laws of Arkansas to merge the Arkansas Light & Power Company, Arkansas Central Power Company, Pine Bluff Company, East Arkansas Power & Light Company and other properties. These companies are now controlled by the Electric Power & Light Corporation, and the latter company will control the new Arkansas Power & Light Company. The new company will serve approximately 100 communities, including Little Rock, Pine Bluff, Arkadelphia, Bauxite, Newport, Russellville, Camden, El Dorado, Stuttgart, Magnolia, Wynne and Searcy. The Arkansas electric properties are already interconnected or soon will be interconnected by 838 miles of high-voltage transmission lines. This transmission system is also interconnected with that of the Louisiana Power Company, which owns the new Sterlington steam plant, and that of the Mississippi Power & Light Company. The Louisiana Power Company and the Mississippi Power & Light Company are also subsidiaries of the Electric Power & Light Corporation, and all are supervised by the Electric Bond & Share Company. H. C. Couch, now president of the Arkansas Light & Power Company, will, it is expected, be president of the Arkansas Power & Light Company. C. J. Griffith, vice-president and general manager of the Arkansas Central Power Company, and J. L. Longino, vice-president and general manager of the Arkansas Light & Power Company, will be vice-presidents.

By the merger of the Deschutes Power Company of Prineville, Ore., into the Bend Water, Light & Power Company of Bend, Ore., the interests of the Deschutes Valley in Oregon will be served by one large light and power company. Interests allied with the Pacific Power & Light Company of Portland and with the Bend company recently acquired control of the Deschutes Power Company, the Enterprise (Ore.) Electric Company and the Grangeville (Idaho) Electric Light & Power Company. Headquarters will be in Portland. The Pacific Power & Light Company and the Bend company are American Power & Light subsidiaries.

It is believed, though not officially confirmed, that the Meyersdale (Pa.) Electric Light, Heat & Power Company, the Garrett (Pa.) Electric Light, Heat & Power Company, the Citizens' Light & Power Company of Salisbury, Md., and the Pennsylvania & Maryland Street Railway Company have been sold by the Wilmoth interests to the American Gas & Electric Company of New York.

The People's California Hydro-Electric Corporation has been authorized by the Railroad Commission to acquire the electric properties of the Alturas Electric Power Company and the Mendocino Electric Light & Power Company, which operate north of the San Francisco Bay region.

What is termed the fifth largest public utility in the United States has been formed by the merger of the Columbia Gas & Electric Company and the Ohio Fuel Company. The new company, to be known as the Columbia Gas & Electric Corporation, will have assets of approximately $500,000,000. Philip G. Gossler, New York, will be president of the new corporation, and George Crawford, Pittsburgh, will be chairman of the board.

Another addition to the system of the American Water Works & Electric Company has been made through the acquisition by the Monongahela West Penn Public Service Company of the electric properties of the Weston (W. Va.) Electric Light, Power & Water Company, serving a population of about 9,000.

The municipal electric plant at Delray, Fla., was taken over on Oct. 1 by the Florida Power & Light Company. The freeholders of Delray approved the action of the City Council to sell the plant. C. H. Ellis, district manager of the West Palm Beach district, stated that the consideration was $300,000. Delray is said to be the ninety-ninth city or community to come into the Florida Power & Light Company's superpower system.

The residents of Erskine, Minn., have voted to sell the municipally owned electric light plant to the Utilities Power & Light Corporation, which operates the Minnesota Electric Light & Power Company and other properties in that state.

Another Wisconsin municipal electric plant will probably pass into the hands of private owners when the people of Kilbourn at the November election vote on the proposal of the Wisconsin Power & Light Company to take over the distribution and lighting systems of the city. A price of $60,000 has been offered, subject to the approval of the Railroad Commission.

Riga, N. Y., and the Niagara, Lockport & Ontario Power Company have asked that the works and system of the Riga electric plant may be transferred to the Niagara company.

A certificate has been filed in the office of the Secretary of State of New York merging the North Creek Electric Company with the Adirondack Power & Light Corporation.

The Platte Valley Power Company of Sioux City and Omaha has purchased the power lines and distribution system of the Hooper Electric Light & Power Company, a Dodge County (Neb.) corporation that also supplies the villages of Nickerson and Winslow with light and power.

Herbert B. Rust, Meredith, N. H., has been granted authority by the New Hampshire Public Service Commission to acquire the properties of the Warren Light & Power Company and to supply electric service to the towns of Wentworth and Warren in that state.

Kanawha in Hancock County, Iowa, voted on Sept. 7, by 233 to 12, to sell its electric distribution system to the Central States Electric Company of Iowa Falls. The town has been buying its energy at wholesale.

The Bradford (Pa.) Electric Company has purchased the municipal electric plant of Port Allegany.

Projects Before the Federal Power Commission

The Mono Mining Company of Nevada has applied to the Federal Power Commission for a license covering a constructed plant on Green Creek in Mono County, Cal. The project consists of a power house, six small dams, four reservoirs and 25 miles of transmission line. The plant has been operated under a Forest Service permit. The power has been used entirely for mining operations. It is now proposed to increase the output by using storage in three lakes owned by the company. The additional power is to be sold for public utility use.

The City Council of Augusta, Ga., has applied for a license authorizing it to raise the elevation of the spillway in the city's existing dam over the Savannah River. The dam is 7 miles above Augusta. The elevation of the spillway is to be raised 18 in., so as to increase the flow in the city's canal and enable it to furnish power to manufacturing plants.

Farm Bureau Deliberates on Muscle Shoals Policy

Defeat of a resolution to indorse specifically the bid of the American Cyanamid Company for the Muscle Shoals plants marked the closing session of a two-day executive committee meeting of the American Farm Bureau Federation held behind closed doors in Florence, Ala., on Sept. 22 and 23. About fifteen members of the executive committee were present and only two voted for the resolution. The majority maintained that the federation's position was strategic and that to indorse any bid at the present time would be premature. According to reports, the bid of the associated power companies has been discussed favorably by members of the bureau's executive committee who have investigated it.

Officials of the Tennessee River Improvement Association escorted the delegates over the Muscle Shoals properties. This association is believed to look favorably on the American Cyanamid Company's bid. The Muscle Shoals Fertilizer Company, a subsidiary of the associated power companies, submitted an analysis of the latter's bid. Another meeting of the executive committee is called for Dec. 6, 7 and 8 in Chicago, simultaneously with the opening of Congress. This is thought to mean that the federation at that time will submit definite legislation to Congress for the disposal of Muscle Shoals. The board of directors of the federation has made a unanimous demand that "Congress be urged to take immediate action for placing Muscle Shoals properties in operation."

Merrill on Basle Meeting

Sees Great Value in World Power Conference Proceedings—Plans Ready for Future Gatherings

QUANTITY and effectiveness of power development are both certain to increase as a result of meetings held under the auspices of the World Power Conference, in the opinion of O. C. Merrill, executive secretary of the Federal Power Commission, who just has returned from the sectional meeting at Basle, Switzerland, where he headed the American delegation. The exchange of information, he believes, and the opportunity to study and compare methods employed in various countries have given added stimulus to the utilization of water for power. In a statement given out on his return Mr. Merrill says, after an account of the formal program and other particulars of the Basle meeting already familiar to readers of the ELECTRICAL WORLD:

"The affairs of the World Power Conference as a whole are handled through the medium of an international executive committee consisting of one member from each of the countries which have organized national committees. The chairman of the committee is D. N. Dunlop of Great Britain, who was organizing director of the first conference at London. The international executive committee holds meetings annually to pass upon matters requiring action and to make arrangements for the sectional and plenary sessions of the conference. Its headquarters at present are in London, and it is supported by voluntary contributions from the participating countries.

"At the meeting of the committee in Basle a draft of a proposed constitution for a more definite organization of the conference was adopted for submission to the various national committees for ratification. Plans were also perfected for a sectional meeting in London in 1928 to be devoted exclusively to a consideration of the fuel problem in its relation to power development. The 1929 meeting of the international executive committee will be held at Como, Italy, in conjunction with the celebration by Italy of the Volta centenary. The next plenary session will be held in 1930 in Italy, if the Italian committee can undertake its organization. Otherwise the meeting is likely to be held in the United States.

"The meeting at Basle this year, supplementing the meeting at London in 1924, has demonstrated the value of such gatherings and the desirability of making the conference a permanent factor in international relations. The exchange of information and the opportunity to study and compare the methods employed by various countries have given added stimulus to power development and have already been reflected in the steps taken by several countries to increase the quantity and improve the efficiency of their power developments. The London conference was the first occasion following the war at which the representatives of all the belligerent nations met on equal terms in a common undertaking. The spirit of amity manifested at London was still more in evidence at Basle. Entirely outside of its value from the technical and economic standpoint, the World Power Conference is proving of undoubted importance as a medium for international contact and for promoting good feeling and mutual understanding among the participating countries."

Briefer News

Boston Edison Asked to Supply Eastern Massachusetts Electric Company.—The Edison Electric Illuminating Company of Boston is seeking the approval of the Massachusetts Department of Public Utilities of a contract providing for the sale of electricity by that company to the Eastern Massachusetts Electric Company, whose manager says that it is more economical for his company to buy electricity from the Edison company than to build an additional plant at this time.

President Chesney Flies High.—When Cummings C. Chesney, president of the American Institute of Electrical Engineers, is in a hurry to get from Pittsfield, Mass., where he is manager

and chief engineer for the General Electric Company, to Schenectady he takes an airplane. The illustration shows him on the point of "jumping off."

Kentucky & West Virginia Power Extensions.—A 40-mile transmission line from Hazard to Jackson, Ky., soon to be built, will complete electrical connection with all the towns on the upper Kentucky and Big Sandy Rivers and tie these places in with lines reaching Welch, W. Va., Zanesville, Ohio, and with several point on the Appalachian system in southwestern Virginia. Including improvements under way in the Lothair generating plant, half a million dollars will be spent. The company has lately extended its lines to various coal fields in its territory.

Kapuskasing, Ontario, to Be Site of Great Pulp and Power Development.—A pulp, paper and power development to be undertaken at Kapuskasing, in northern Ontario, by the Kimberley-Clark Company of Wisconsin and the New York Times Company will be of huge size. Adolph S. Ochs, president of the New York Times Company, who has just made a tour of inspection of the district selected for the big project, says that under a charter to the Spruce Falls Power & Paper Company, Ltd., $25,000,000 will be expended to get a daily production of 550 tons of newsprint and upward of 200 tons of sulphite. Power for the plant will come from Smoky Falls, 50 miles in from Kapuskasing, where there is 75,000 hp. available, and there are two or three other sites in the 4,500 square miles of leases that can be harnessed. Upward of 5,000 people, Mr. Ochs estimates, will be employed by the industry.

Progress on Oswego (N. Y.) Varick Canal Plant.—Operation of the Varick Canal plant of the Oswego River Power Corporation at Oswego, N. Y., is expected to begin some time in November. About 75 per cent of the machinery is now in place. Five generating units rated at 2,250 kw. each are being installed, and a sixth will be added when demands require it. A transmission line has been built between Oswego and Altmar, where there will be a tie-in with Northern New York Utilities and the Niagara, Lockport & Ontario power systems. The plant will cost upward of $2,000,000.

Ontario Hydro Gratified by St. Lawrence Plan of New York Commission.—The Hydro-Electric Power Commission of Ontario, in a statement issued on Sept. 29, expressed gratification that the interests of Ontario had been fully recognized by the New York State Water Power Commission in its plans for the development of the St. Lawrence River. The Ontario commission's statement followed publication of the New York board's decision to proceed with the "single-stage" plan of development which provides for a dam near Barnhardt Island to develop the entire fall in the river between Lake Ontario and that point.

Change in Construction Plans for Osage River Development Likely.—A change in the plans for the 125,000-hp. hydro-electric project near Bagnell, Mo., on the Osage River, so that the full regulation of the river may be secured, seems probable. This will necessitate a material extension of the reservoir. The construction plant has been assembled and the excavation for the foundation of the dam has been completed. The uncertainty as to the extension of the reservoir has resulted in some delay in construction as under the changed plans a heavier foundation will have to be provided. The licensee of the project is Walter Cravens of Kansas City.

American Welding Society to Meet at Buffalo Next Month.—The annual fall meeting of the American Welding Society will be held at Buffalo on Nov. 17-19. A large welding exposition in the Broadway Auditorium, where the sessions of the society will be held, will be a feature. Technical sessions will include authoritative papers and discussions on "The Design and Development of Welding Apparatus," "Organization of Welding on the Railroads," "Welding of Locomotive Parts," "Welding Science in the Engineering Curriculum of Universities" and "Arc Welding in a

Gaseous Atmosphere." A meeting of the American Bureau of Welding and of the welding wire specifications subcommittee will be held Thursday afternoon, Nov. 18.

Three Towns Seek New Power Plant of Eastern Shore Company.—Salisbury, Md., Seaford, Del., and Vienna, Md., are competitors in the matter of affording a site for a new power station which the Eastern Shore Gas & Electric Company purposes building at a cost of $1,500,000. The new plant will be one of the largest in the section.

Empire District Company to Enlarge Kansas Plant.—The coming expenditure of about $4,000,000 for new equipment and buildings at the Riverton (Kan.) power plant of the Empire District Electric Company is announced by General Manager J. E. Harsh. Improvements include the installation of a 26,250-kw. turbo-generator with auxiliary equipment. This machine is to be ready for operation by January, 1928, and will bring the rating of the plant, which is the largest in Kansas, to approximately 100,000 kw. The Empire District company, with headquarters at Joplin, Mo., serves many towns in southwestern Missouri, southeastern Kansas and northeastern Oklahoma.

Tacoma's Plans for More Power Meet Opposition.—That the city of Tacoma, Wash., may have considerable difficulty in overcoming protests against the proposed taking of 600 cu.ft. of water from the South Fork of the Skokomish River to make possible the addition of the final unit to the city's six-million-dollar Lake Cushman power project has become evident. Ranches in the valley below the proposed point of diversion fear the loss of water if the city tunnels a conduit from the South Fork to the present power house, 4 miles distant. The ranchers claim that approximately 3,000 acres of fertile valley land, now used for orchards and farming, would be left barren and useless with the lowering of the river level. J. L. Stannard, chief engineer of the power project, holds that numerous streams tributary to the South Fork of the river below the point of the proposed diversion would maintain the fertility of the section. State Hydraulics Supervisor Tiffany will make a trip of inspection before giving his decision.

Central & Southwest Utilities Shifts Headquarters from San Antonio to Dallas.—General offices of the Central & Southwest Utilities Company have been moved to Dallas from San Antonio, with James C. Kennedy, vice-president, in charge. The subsidiary companies which will be under the supervision of the Dallas office include the American Public Service Company, operating in east and west Texas and Oklahoma; the Central Power & Light Company of San Antonio, operating in southwest Texas and the Panhandle; the Public Service Company of Oklahoma and the Chickasha Gas & Electric Company, both with headquarters at Tulsa, Okla.; the Southwestern Light & Power Company, Oklahoma City, and the Southwestern Gas & Electric Company, Shreveport, La. Installation of power plants and high-tension lines for this system in various parts of Texas, Oklahoma and Louisiana in the past twelve months cost more than $12,000,000, divided as follows: East Texas Public Service Company, Marshall, $1,250,000; West Texas Utilities Company, $2,000,000; Central Power & Light Company, $8,000,000; $2,000,000 is being spent this year in Oklahoma expenditures.

Associated Gas & Electric Expending $14,500,000 for Construction. — Information on its 1926 budget expenditures just given out by the Associated Gas & Electric Company puts the total outgo for new construction at $14,547,500, of which $6,555,000 had been spent up to Aug. 1. Most of the items are electrical, although the total includes gas and waterworks outlays. Included among sums for work under way or soon to be begun are $1,541,000 for another 15,000-kw. turbine and accessory equipment for the Staten Island Edison Corporation, to be installed at its Livingston plant; appropriations for five new substations for the Penn Public System, besides two new links in this company's 132,000-volt line to Niagara and the extension of its 110,000-volt line northward from Union City, Pa., to Erie, and substantial provision for construction in the western, northern, eastern and Harlem Valley districts in New York State, the Cape Cod and Martha's Vineyard district in Massachusetts, the Kentucky-Tennessee area and the city of Manila, P. I.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

North Atlantic Section, American Society of Agricultural Engineers—State College, Pa., Oct. 11-13. R. T. Wagner, 1 River Road, Schenectady.

Eastern Association of Electrical Inspectors—Hotel Pennsylvania, New York, Oct. 13 and 14. E. P. Slack, 85 John St., New York.

Kansas Section, N. E. L. A.—Manhattan, Kan., Oct. 14-16. H. Lee Jones, 401 National Reserve Bldg., Topeka, Kan.

Electrical Supply Jobbers' Association — Atlantic City, Oct. 18-22. F. Overbagh, 411 South Clinton St., Chicago.

Electric Power Club—Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

National Safety Council — Detroit, Mich., Oct. 25-29. W. H. Cameron, 168 N. Michigan Ave., Chicago.

National Association of Railroad and Utilities Commissioners—Asheville, N. C., Nov. 9-12. J. B. Walker, 270 Madison Ave., New York.

American Engineering Council—Administrative board, Ithaca, N. Y., Nov. 11 and 12. L. W. Wallace, 26 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers — Regional meeting, New York, Nov. 11-12. F. L. Hutchinson, 33 West 39th Street, New York.

National Electrical Credit Association—Philadelphia and New York City, Nov. 12. F. P. Vose, 1008 Marquette Bldg., Chicago.

Empire State Gas and Electric Association — Electric Meter Section, Hotel Seneca, Rochester, Nov. 15 and 16. C. H. B. Chapin, Grand Central Terminal, New York.

American Welding Society — Buffalo, Nov. 16-19. M. M. Kelly, 29 West 39th Street, New York.

American Society of Mechanical Engineers—New York, Dec. 6-9. C. W. Rice, 29 West 39th St., New York.

Agricultural Engineers to Discuss Rural Electrification in the East.—Meeting at Pennsylvania State College, Pa., on Oct. 11, 12 and 13, the North Atlantic Section of the American Society of Agricultural Engineers will devote its afternoon session on the second day to farm electrification. Four papers on this subject are scheduled: "Economic Aspects of Rural Electrification," by Dr. G. S. Warren, professor of agricultural economics, New York State College of Agriculture; "The Farmer's Views on Rural Electrification," by Miles Horst; "Rural Electrification in Virginia," by C. E. Seitz, professor of agricultural engineering, Virginia Polytechnic Institute, and "Rural Electrification in New Hampshire," by W. T. Ackerman, electrical project engineer, New England Rural Electrification Project, Durham, N. H. There will also be a round-table discussion of electrification on the evening of Oct. 11.

Northwestern River Maps Made Available.—Most of the larger streams of the Olympic peninsula, in northwestern Washington, have their sources on the glacial slopes of the Olympic Mountains within the boundaries of the Mount Olympus National Monument and the Olympic National Forest. The Geological Survey has begun a survey of these streams, which, since they have a well-sustained flow and a very heavy grade, constitute a valuable power resource. In 1925 E. E. Jones, hydraulic engineer of the Geological Survey, made plane-table surveys of the North and South Forks of Skokomish River, Dosewallips and Hamma Hamma Rivers and Lilliwaup Creek. The resulting maps, though possibly subject to some errors of location or elevation, have value for preliminary estimates of power. Copies can be procured at a nominal price from the district office of the Geological Survey, Tacoma, Wash.

Rehabilitation and Construction in South Oklahoma.—Since properties of the Consumers' Light & Power Company were added to the southern division of the Oklahoma Gas & Electric Company following their purchase in June, 1925, more work in rehabilitation and added equipment has taken place there than in any other division. High-voltage lines have been built, new towns connected, substations erected and distribution lines rebuilt. Work of raising the voltage on the Ardmore-Durant line from 13,000 to 33,000 has been finished. This line will be tied in to the Horseshoe Lake and Byng generating stations within a month or so. Poles are set and the aluminum conductor is being strung on the Ada-Sulphur line, which will carry 63,000 volts. This line is of "H-frame" construction and will be one of the connecting links between the Horseshoe Lake, Byng and Ardmore plants. Extensive changes are also being made in the Byng and Sulphur substations. The line from Ardmore to Wilson, Healdton and Ringling is rapidly nearing completion.

Men of the Industry

R. J. Andrus Joins Foshay Interests

R. Joel Andrus, vice-president of the Twin State Gas & Electric Company, with headquarters at Boston, and one of the most prominent engineers for the Insull properties in the East, has resigned to become vice-president and general manager of the People's Light & Power Corporation, the parent company of the W. B. Foshay Company holdings, headquarters in Minneapolis. Mr. Andrus will also be vice-president of the Foshay company. He will have charge of the management and operation of all the public utilities in this group. Following his graduation from the electrical engineering course at the University of Minnesota in 1907, Mr. Andrus became associated with the R. E. Strahorn interests in the Pacific Northwest and engaged in management activities in the Yakima Valley in central Washington. For a time he was vice-president and general manager of the Northwest Electric & Water Works, with offices at Seattle. In 1916 he went to Vincennes, Ind., to take up construction work for the Indiana Power & Water Company, and in 1917 he joined the Insull properties in the Central West, later making headquarters at Chicago. In 1922 he went to Boston as chief engineer of the Twin State System and was recently appointed vice-president in charge of engineering, also being made vice-president of the Insull properties centering in southern Vermont and lower New Hampshire. Mr. Andrus has contributed several valuable articles to the ELECTRIAL WORLD since going to Boston and is widely recognized as an authority upon the economic aspects of engineering in public utilities.

Edwin Jowett, vice-president in charge of power-plant construction and operation of the Kansas City (Mo.) Power & Light Company, has been made president of the Canadian Construction Company, which is building a 10,000-kw. plant for the Panhandle (Tex.) Power & Light Company.

F. M. Feiker, operating vice-president of the Society for Electrical Development, with headquarters in New York, has been appointed by Secretary of Commerce Hoover to the new advisory committee which will co-operate with the United States Department of Commerce's domestic commerce division. Mr. Hoover's object in creating the committee is "to establish closer contact between the department and the field of trade and commerce in order to render better service to business men and the public and to advise the domestic commerce division in its efforts to eliminate waste in distribution."

Edgar D. Doyle, formerly assistant chief engineer of the Electrical Testing Laboratories, New York, has recently been appointed electrical engineer for the Leeds & Northrup Company, electrical measuring instruments manufacturer, Philadelphia. Mr. Doyle severed his connection with the testing laboratories after an association which began in 1911, when he became technical assistant. Two years later he was made assistant engineer, which position he held until 1924, when he was promoted to be assistant chief engineer. A native of Bloomington, Ill., and a graduate of the University of Illinois, Mr. Doyle spent one year in the testing department of the General Electric Company before removing to New York. Mr. Doyle has been active in the affairs of the American Institute of Electrical Engineers, at the present time serving as a member of the instruments and measurements committee.

T. T. Richards Leaves Wagner Organization

Thomas T. Richards is severing his connection as vice-president and sales manager of the Wagner Electric Corporation after 21 years' association with that company. Mr. Richards joined the Wagner forces in 1905 as a sales promotion man to further the sale of electrical instruments at that time manufactured by the Wagner corporation. He was successful in building this business up and undertook the duties of manager of the new-business department, later being made assistant sales manager of electrical apparatus sales. In 1918 he was made sales manager of the company, and in 1923 he was elected to a vice-presidency in charge of electrical apparatus sales.

Mr. Richards is leaving the Wagner corporation to take the position of sales manager of the Arthur B. Shepard Corporation, New York, manufacturer of structural-steel buildings. At a meeting of the executives and district managers, Sept. 28, and on their behalf, Mr. Richards was presented with a handsome watch and chain, and he was tendered a dinner at the Forest Park Hotel by 55 of his associates in the Wagner Electric Corporation.

M. C. Smith, for several years manager of the Cape Breton Electric Company at Sydney, Nova Scotia, has been appointed manager of the Baton Rouge (La.) Electric Company to succeed Alves Dixon, who was forced to relinquish his managerial duties because of ill health. Mr. Smith has been associated with companies under Stone & Webster management for fourteen years.

Leon P. Feustman, vice-president of the Worthington Pump & Machinery Corporation in charge of general commercial affairs, has resigned, his resignation having taken effect on Oct. 1. Mr. Feustman's connection with the Worthington company dates back to 1903, when he became vice-president of the Power & Mining Machinery Company, now a subsidiary of the Worthington Pump & Machinery Corporation. He is a native of Philadelphia and a graduate of the University of Pennsylvania. Following graduation he spent six years in Colorado, engaging in mining engineering, and subsequently removed to Mexico as the representative of the American Smelting & Refining Company. In 1900 he was sent to New York to represent the same interests, three years later affiliating himself with the Power & Mining Machinery Company.

J. E. Johnson and L. A. Pettit, Jr., Receive Promotions

Charge of the operation of the Illinois light and power properties of the Illinois Power & Light Corporation, with headquarters at Chicago, has been assumed by **J. E. Johnson**, with the title of operating vice-president, and **L. A. Pettit, Jr.**, assumed charge of the operation of the Missouri properties on Oct. 1, with the title of operating vice-president, his headquarters being at Kansas City. For convenience in operation and with the purpose of rendering the best service possible, a new company group has been created, to be known as the Central Illinois group of the Illinois Power & Light Corporation properties. This group will consist of the Danville, Champaign, Decatur, Bloomington, Peoria and Jacksonville divisions, and all division managers will report to M. L. Harry, with headquarters at Decatur and the title of general manager, Central Illinois group.

Obituary

Anderson Gilbert Moore, industrial agent for the Interstate Public Service Company, Middle West Utilities Company and Kentucky Utilities Company, died Sept. 28 at his home at New Albany, Ind., from heart disease and double pneumonia. Mr. Moore was a native of Princeton, Ind.

Clermont Harvey Wilcox, president of the New York Insulated Wire Company and for many years head of the banking and brokerage house of Wilcox & Company, New York, died Oct. 2 in the Fifth Avenue Hospital after a short illness, at the age of 76. Mr. Wilcox was one of the founders of the New York wire company and had always been its president.

Alfred Craven, prominent engineer and formerly chief engineer of the Public Service Commission of the State of New York, died Sept. 30 at Pleasantville, N. Y., where he had been living since his retirement six years ago from the position of consulting engineer to the commission. A native of Bound Brook, N. J., and a graduate of the Naval Academy, class of 1867, Mr. Craven is especially known for his work in connection with the construction of the subways of New York City.

John J. Stanley, a prominent figure in public utility circles, dropped dead at the Union Club in Cleveland on Oct. 4 immediately after a speech given at a dinner in honor of his friends attending the convention of the American Electric Railway Association in that city. Mr. Stanley was a native of Cleveland and was educated at the public schools there. He had been identified with the street railways of

the city since 1885 and was president of the Cleveland Railway Company at the time of his death. In addition to his duties as chief executive of the railway company, he devoted considerable time and energy to the affairs of the American Electric Railway Association, of which organization he was a past-president. Mr. Stanley was 63 years of age.

Robert W. Adams died suddenly Sept. 28 in his forty-fourth year. Mr. Adams had been a salesman for the Atlanta office of the Westinghouse Electric & Manufacturing Company for the past eighteen years.

William H. Thornley

William H. Thornley, president of the Tubular Woven Fabric Company, Pawtucket, R. I., and widely known to the electrical industry as the last president of the Associated Manufacturers of Electrical Supplies, died at his home in Providence, Oct. 5, in his fifty-seventh

W. H. THORNLEY

year, having been born in Halifax, Pa., in 1869. Although primarily of the legal profession and extensively interested in other industrial fields, Mr. Thornley in recent years became very active in the affairs of the electrical manufacturers' organizations and an outstanding figure in the councils of the supply manufacturers in particular. He served finally as president of the Associated Manufacturers of Electrical Supplies for two terms—1924 to 1926—and effectively guided the preliminary steps of the merger of that body with the Electric Power Club to form the newly organized National Electrical Manufacturers' Association. In relatively few years of active association with electrical affairs his sound judgment and unusual executive ability had made him one of the guiding counselors of the industry.

Mr. Thornley was a graduate of Brown University and the Harvard Law School and entered upon his career as a corporation lawyer. It was fourteen years ago that he affiliated himself with the electrical industry, when he became president of the Tubular Woven Fabric Company. In addition, Mr. Thornley at the time of his death was serving on the board of the Centerdale Worsted Mills, Centerdale, R. I., the Gerry Estates, Inc., of New York and the Lisk Manufacturing Company of Canandaigua, N. Y.

Commission Rulings

Generation of Utility Product in Another State Not Valid Objection to Permit.—The Illinois Commerce Commission in adjudicating a dispute between two gas companies both desirous of serving Venice, Ill., declared that it was not a valid objection to the grant of a certificate to construct and operate such a utility system that the product would be generated in another state, since the gas would be purchased in Illinois and the commission would therefore have ample authority to require proper standards of service. It further declared that a certificate to construct and operate a gas system in the village would be granted to the prior applicant, which alone had obtained the consent of the municipal authorities, notwithstanding that there might be a question as to the validity of the ordinance expressing the consent—a matter outside the commission's jurisdiction.

Added Risk from Enlargement of Plant Not an Element in Valuation.—A value for an alleged added risk to the Tennessee Eastern Electric Company from enlarging one of its plants to nearly double size was not included in a rate base by the Tennessee Railroad and Public Utilities Commission. On this point the commission observed: "The enlargement was made to keep step with the community the company serves. During the whole period the company was subject to regulation by the state and knew that it was only entitled to earn a fair return on the value of its property used for the public convenience. We know of no principle that would entitle the company to such an allowance in the rate base. There was no risk involved in the enlargement of the company's plant other than is ordinarily involved in such enterprises, nor was there any other risk involved in enlarging the plant than there was when the plant was first constructed. Whatever risks were involved were those risks ordinarliy incident to the business and applying to all other like public utilities, and the company understood at all times that it was entitled to a fair return and no more, and this return is based in part upon the risk incident to the business."

What Differentiates Public and Private Utilities. — In adjudicating a case affecting the Ellis Electric Company the Missouri Public Service Commission enunciated the principle that neither the surrender by a public utility of its operative franchise to the municipality nor the mere determination by it not to operate as a public utility effects a change of status from that of a public to that of a private utility. The commission said: "The question of whether a utility is public or private is one of fact and does not depend upon the utility having a franchise. A franchise, when granted a utility by a municipality, gives to the utility certain named rights and is granted only for that purpose. The jurisdiction of this commission over a utility is granted by statute of the State of Missouri and cannot be taken away or affected by the action of the town board. Again, the determination of the owner of a public utility to cease to operate his plant as such does not of itself make it a private utility. Before it ceases to be a public utility it must cease to serve the public and devote its services to private interests. This the defendant has not done. It still serves the public for pay, receiving therefor about $70 per month, but refuses service to those who would not enter into a personal contract. If it decides to abandon the field of public utility service, it should make application to the Public Service Commission for authority so to do, stating the reasons that have actuated its course."

Recent Court Decisions

Law Limiting Powers of Villages to Finance Utilities Found in Conflict with Michigan Constitution.—The Supreme Court of Michigan, in Michigan Light & Power Company vs. Village of Hart, found that an act of the Legislature limiting the power of villages to issue bonds to finance a public utility, taking as security a mortgage on the utility, was in conflict with a constitutional provision authorizing the issuance of mortgage bonds beyond the general limit of bonded indebtedness for the acquisition of a public utility. The constitutional provision, the court said, applied regardless of whether a village has adopted home rule provisions by affirmative act, since it does not require legislation. (209 N.W. 937.)*

Fair Value for Rate Making.—Refusing to dismiss a complaint of the city of Rochester against the New York State Railways which concerned the appraisal of the property of the latter—an appraisal not indorsed by the Public Service Commission and called in question by the Bureau of Municipal Research—the Supreme Court of New York found that an appraisal based upon the cost of production without taking into consideration depreciation, and which fixes a base value without giving due weight to the elements of valuation used in rate-making cases, is erroneous. The present value of a public utility for rate making, the court held, is not the cost of reproduction less depreciation if the application of the rule due to price inflation will give the utility more than a reasonable return on its property and subject the public to an excessive rate. Nor is a fair value for rate making the value for exchange, but such a value, found after considering all relevant facts, as will give the public utility a reasonable return and the public a reasonable rate. It must permit the utility to meet its operating and maintenance expenses and its financial obligations with a reasonable excess for dividends and ordinary contingencies. (217 N.Y.S. 452.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Volume of Trading Small

More Activity Among Preferred Issues than Elsewhere—Money Situation Has Little Influence

ABOUT the only variation which the public utility security markets have shown from the general markets during the week is that the tendency to liquidate has been lacking. Most issues have held firm and there were some gains. The drop in the call-money rate seems to have had little effect up to the present.

Preferred issues have again been the feature of the market for these securities during the week. In general, demand for high-grade preferred stocks considerably exceeded the supply. This was due, partly at least, to heavy institutional buying, especially by insurance companies. There has been very keen interest, for example, in the 7 and 8 per cent preferred issues of Penn-Ohio Power & Light, both of which made gains. Florida Power registered a gain of one and a half points despite the consequences of the recent disaster. Southeastern Power & Light 7 per cent preferred also gained one and a half points, and Minnesota Power & Light was stronger. Adirondack Power & Light 7 per cent preferred showed some weakness, but this was due, apparently, to selling in connection with conversion operations.

Common stocks generally are back to the levels of three or four months ago. Despite the buying incentive involved in cheap money, these issues refuse to react. There were no outstanding gains, although the index number of twenty representative common stocks computed by the ELECTRICAL WORLD gained nearly two points during the week. This end of the utility market follows the general market quite closely.

While there has been heavy buying and also selling in public utility bonds, price levels have been well maintained, no important changes registering in either direction.

Montreal Utility Floats Substantial Loan

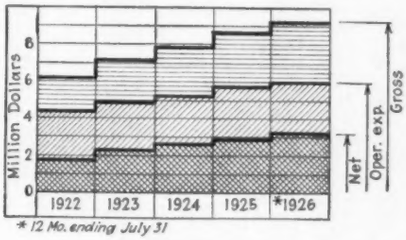
On Sept. 29 shareholders of the Montreal Light, Heat & Power Consolidated approved the creation of an issue of first refunding and collateral trust bonds, amounting to $75,000,000, to be issued in series as required. Of this total $30,000,000 has already been raised through the flotation of bonds simultaneously in the United States, Canada and abroad. These bonds, dated Oct. 1, 1926, and maturing Oct. 1, 1951, were priced at 99.50 and interest, yielding over 5.03 per cent. The Montreal Light, Heat & Power Consolidated operates one of the largest public utility systems in Canada, owning more than 99 per cent of the issued capital stocks of Montreal Light, Heat & Power Company and of the Cedars Rapids Manufacturing & Power Company. Under operating agreements, it operates their business and properties and receives all their revenues for 98 years from 1916.

The bonds will constitute the only present funded debt of Montreal Light, Heat & Power Consolidated. They will be secured by trust deed constituting a first specific mortgage and charge on (1) the fixed assets of the company, (2) the company's holdings of shares, bonds or other evidences of indebtedness of subsidiary companies, (3) the company's holdings of preferred and common shares of United Securities, Ltd., (4) the operating agreements with the Montreal Light, Heat & Power Company and the Cedars Rapids Manufacturing & Power Company, and (5) certain power contracts with the Shawinigan Water & Power Company. The bonds will also be secured by a floating charge upon all the company's assets not covered by the specific charge.

Birmingham Electric Income Up 17 per Cent

Gross Earnings for Year Ended July Show 12 per Cent Increase, and Number of Customers Has Risen Rapidly in Last Few Years

SERVING a population of about 300,000 in and around Birmingham, Ala., the Birmingham Electric Company, the leading subsidiary of the National Power & Light Company, has shown rapid progress. The company today supplies virtually all the electric power as well as the light, street-railway and gas service in the cities of Birmingham, Bessemer and Fairfield, Ala., and operates utilities in adjoining territory.



INCOME OF BIRMINGHAM ELECTRIC SHOWS RAPID GROWTH

The company as now constituted was incorporated in 1924, acquiring the property of three then existing utilities in the district. The customers have increased rapidly in number.

The progress of Birmingham Electric is vividly shown in the earnings record. Taking the year ended July 31, gross was $9,155,728—an increase of 12 per cent during the year. Operating expenses were $5,991,571, or 65 per cent of gross earnings. The ratio of funded debt to gross earnings is unusually favorable, the debt being but 1⅛ times gross, against a ratio which is frequently as high as five to one.

Net earnings from operation for the period under discussion were $3,164,157, a 16 per cent gain in a year. This is three and three-fifths times the bond interest charges of $866,294, which is a creditable earning ratio. The balance available for preferred dividends was $2,295,325, from which must be deducted renewal and replacement reserves. Preferred dividends required $270,022, leaving a balance of $2,025,303. For the calendar year 1925 this replacement fund was $691,401, and the balance for preferred was $1,325,574, which represents earnings of $34.52 a share.

The funded debt of the Birmingham Electric includes $8,000,000 first and refunding 6 per cent mortgage bonds of the Birmingham Electric Company and $8,546,000 general mortgage refunding bonds of the Birmingham Railway, Light & Power Company, bearing a 4½ per cent coupon rate. This indebtedness is followed by 46,563 shares of cumulative preferred stock paying $7 and by 800,000 shares of no-par common. The former is currently quoted around 105, which would give the total issue a value of about $4,889,000. Common stands at around $22.50, which gives a total value of $17,967,641.

The company's balance sheet as of July 31 showed the value of plant at $43,295,503 and total assets at $44,946,465. Operations are supervised by the Electric Bond & Share Company. The future earning possibilities of the company are unusually attractive.

Worcester Merger Plan Placed Before Commission

The first hearing on the proposed consolidation of the Worcester Gas Light Company and the Worcester Electric Light Company of Worcester, Mass., was held recently before the Public Utilities Commission. George Dewey, counsel for the electric company, outlined briefly the proposed plan for consolidation, which would provide that the electric company would take over the franchise, assets and liabilities of the gaslight company. The financial change would provide for an issue of 24.000 shares of new capital stock at $75 a share by the Worcester Electric Light Company to take up the outstanding preferred stock of the Worcester Gas Light Company of $350,000 and

outstanding bonds amounting to $1,400,000. The general plan is for the electric company to issue two shares of its common stock for five shares of Gas Light stock. This plan has already been approved by a two-thirds vote of each class of stockholders, as provided by law, and the consolidation has been authorized by an act of the 1926 Legislature.

In answer to a question by Chairman Henry C. Attwill of the Public Utility Commission, Mr. Dewey stated that the market price of Gas Light shares was $60 and of the Electric Light shares $150. John H. Fahey said that the general public of Worcester was in favor of the consolidation, but that the real problem at hand was the basis on which the two companies would be joined. The commission was reluctant to vote on the matter and desired to wait for further information. A continuance until Oct. 16 was granted.

Mountain States Power Increases Stock.—Stockholders of the Mountain States Power Company on Sept. 30 increased the authorized preferred stock from 50,000 to 150,000 shares, par $100, and the common stock from 200,000 shares without par value to 500,000 shares.

New Capital Issues

During the week ended Oct. 7 the Cleveland Electric Illuminating Company issued general mortgage 5 per cent gold bonds, series B, to the amount of $10,000,000, the price being 102½ and accrued interest, to yield about 4.85 per cent. These bonds were dated Oct. 1, 1926, and mature Oct. 1, 1961. The general mortgage bonds, of which $11,500,000, issued as series A, are outstanding, are a direct obligation of the company, secured by direct mortgage lien on the entire fixed property of the company now owned or hereafter acquired, subject only to $18,500,000 first mortgage 5 per cent bonds due in 1939 outstanding in the hands of the public.

The Gulf States Utilities Company made an offering of 5 per cent first mortgage and refunding gold bonds to the amount of $9,000,000, the price being 96 and accrued interest, to yield over 5.25 per cent. The proceeds from the sale of these bonds will be applied toward the retirement of debt incurred for the purchase of properties and the construction of the new Neches power station and transmission lines and to other corporate purposes.

Gold debentures of the Standard Gas & Electric Company, amounting to $7,500,000, were offered at 99 and interest, to yield about 6.08 per cent, the purpose being to reimburse the company for expenditures made in the acquisition of public utility securities and for other purpose.

A piece of short-term financing was done by the Commonwealth Light & Power Company in the form of one-year 6 per cent secured gold notes totaling $2,000,000. These securities, dated Oct. 1, 1926, and maturing Oct. 1, 1927, were priced at 100 and accrued interest. Through its subsidiaries the company furnishes public utility service to 245 communities in Michigan, Missouri, Kansas, Arkansas and Texas, serving a combined population of approximately 226,000. The notes will be secured by deposit with the trustee of $1,550,000 Commonwealth first lien 6 per cent bonds and $542,000 in notes of subsidiary operating companies. In addition, there will be deposited such securities of subsidiary companies as will be received by the company for approximately $500,000 cash provided through the sale of these one-year notes, which money will be advanced to subsidiaries for capital expenditures.

The Tide Water Power Company issued $1,500,000 7 per cent preferred stock at 97½ and accrued dividend.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Oct. 5	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.—no par	94	70¼	98
Adirondack Pwr. & Lt.—7% pf.	105½	....	....
Adirondack Pwr. & Lt.—8% pf.	113	....	....
Ala. Pwr., pf.	107	....	....
Allis-Chalmers Mfg. pf.	k108	105	110½
Allis-Chalmers Mfg., com.	88½	78½	94¼
Aluminum Co. of Amer., com.	73	54½	76
Aluminum Co. of Amer. new, pf.	101	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	83½	79	98
Amer. & Foreign Pwr., com.—no par	15½	14½	42
Amer. Bosch Magneto, com—no par	18	16	34½
Amer. Brown, Boveri, Elec.	43½	30½	50
Amer. Brown, Boveri, Elec., pf.	k 96	86½	97½
Amer. Elec. pwr, pf.	m111	102	111
Amer. Gas & Elec., 6% pf.—no par.	95½	90½	95½
Amer. Gas & Elec., com.—no par.	105	64	110½
Amer. Lt. & Trac., 6% pf.	108½	105	115½
Amer. Lt. & Trac., com.	215	193	263
Amer. Pwr. & Lt., 6% pf.	97	92	99
Amer. Pwr. & Lt., com.—no par.	m 66½	50½	72
Amer. Pub. Serv., 7% pf.	a 97½	92	99
Amer. Pub. Serv., com.	50	45	80
Amer. Pub. Utilities, 6% pf.	84	....	....
Amer. Pub. Utilities, 7% pf.	92½	....	....
Amer. Pub. Utilities, com.	70	....	....
Amer. States Sec., A	3½	....	....
Amer. States Sec. B	3½	....	....
Amer. Superpwr., pf.—25	26	23	26½
Amer. Superpower, pf.	l 95	....	....
Amer. Superpwr., Class A—no par.	29	19½	37½
Amer. Superpwr., Class B—no par.	31	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	103½	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	58½	43½	74
Anaconda Copper	49	41½	51½
Appalachian Pwr., 7% pf.	95	90	101
Appalachian Pwr., 1st pf., 7%	95	99	102
Appalachian Pwr., com.	78	78	83
Arizona Pwr., 7% pf.	60	....	....
Arkansas Cent. Pwr., pf., $7—no par	k105	99	107
Arkansas Lt. & Pwr., 7% pf.	103	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	l108	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	82	....	....
Assoc. Gas & Elec., Class A—no par	35½	25½	38½
BABCOCK & WILCOX, com.	116	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	105	110
Birmingham Elec. pf.—$7—no par.	105	....	....
Blackstone Valley Gas & Elec., pf.	103	103	106
Blackstone Valley G.&E., com.—50.	k100	....	....
Blaw-Knox, com.	l 75½	45	80
Brazilian Trac., Lt. & Pwr., com.	f118	....	....
Broad River Pwr., pf.	95	....	....
Brooklyn Edison, com.	156½	133	163
Buffalo, Niagara&East.Pwr.,pf.—25.	l 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	l 30½	....	....
CALIFORNIA ELEC. GENERATING, pf.	92	89	95
California Ry. & Pwr., pf.	105	88	115
Carolina Pwr. & Lt., pf.—$7—no par	107½	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 93	89½	96½
Cent. & S. W. Ut., pr. ln. pf.—no par	a 99	93	100
Central Ariz. Lt. & Pwr., pf.	104	....	....
Central Ark. Ry. & Lt., 7% pf.	100	....	....
Central Ill. Pub. Serv., 6% pf.	a 90	87	91
Central Ind. Pwr., 7% pf.	88½	84	90
Central Pwr. & Lt., pf.	100	....	....
Central States Elec., 7% pf.	92	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m115	110	116
Chicago Fuse Mfg., com., no par.	a 30½	30	35
Cincinnati Gas & Elec., com.	g 90	88	95
Cities Service, 6% pf.	l 89½	86½	89½
Cities Service, pf.B—10.	l 7½	7½	7½
Cities Service, pf. BB—100.	l 77½	74	79
Cities Service, com.—20.	l 45½	37½	45½
Cities Service, Bks. Shrs.—10.	l 22½	19½	22½
Clarion River Pwr., pf.	95	95	96
Cleveland Elec. Illg., 6% pf.	107	....	....
Cleveland Elec. Illg., com.	295	....	....
Colorado Pwr., 7% pf.	k 95	96	97
Columbia Gas & Elec., 7% pf.	k114½	111½	115½
Columbia Gas & E., com.—no par.	82	63½	90
Columbia Ry., Gas & Elec., 6% pf.	98	97	100
Columbus Elec. & Pwr., 2d pf.	104	....	....
Columbus Elec. & Pwr., com.	275	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	98½	....	....
Columbus Ry., Pwr. & Lt., pf. B.	94	....	....
Col. Ry., Pwr. & Lt., com.—no par.	69	....	....
Commonwealth Edison, com.	a138½	135½	145
Commonwealth Pwr., 6% pf.	90½	82	90½
Commonwealth Pwr., com—no par.	41½	28½	43½
Conn. Lt. & Pwr., 8% pf.	117	....	....
Conn. Lt. & Pwr., 7% pf.	108	....	....
Cons. Gas of N. Y., pf.—50.	58	....	....
Cons. Gas of N.Y., com.—no par.	108½	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e106	102	107½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e110	108½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e112½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e126	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 52½	45	57½
Cons. Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	98	....	....
Consumers Pwr., 6.6% pf.	104	....	....
Continental Gas & Elec., 7% pte. pf	101	....	....
Continental Gas & Elec., 7% pr. pf.	97½	....	....
Continental G.&E., com.—no par.	140	....	....
Crocker Wheeler, com.	21	....	....
Crocker Wheeler, pf.	57	....	....
DALLAS PWR. & LT., 7% pf.	107	....	....
Dayton Pwr. & Lt., 6% pf.	99½	....	....
Detroit Edison, com.	138½	123½	141½
Dubilier Condenser & Rado, com.—no par.	k 4½	4½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	114½	111½	116½
EAST, N. Y. UTIL. pf.	103	80	104
Eastern New York Util., com.	65	70	75
Eastern States Power.	14	....	....
Eastern States Power, pf.	89	....	....
Eastern Tex. Elec., 7% pf.	105	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	d227	207	250
E. Paso Elec., com.—no par.	70	70	94
E. Paso Elec. pf.	103	....	....
Elec. Bond & Share, 6% pf.	l108	103½	109½
E. Bd. & Share Sec., com.—no par.	l 68½	56½	86
El. Household Util.	a 14	13	25
Elec. Investors, 6% pf.—no par.	92½	....	....
Elec. Investors, com.—no par.	40½	30½	74½
Elec. Investors, 10% pd. receipts.	25	12	56
Elec. Pwr. & Lt., ctfs, pf.	94½	89½	98½
Elec. Pwr. & Lt., ctfs., 40% pd.	102½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	102½	102½	110½
Elec. Pwr. & Lt., ctfs., com—no par.	17	15½	34½
Elec. Refrig.	59½	59½	78½
Elec. Ry. Securities, com.—no par.	k 5½	4½	10
Elec. Storage Battery, com.—no par.	88½	71½	94½
Elmira Wtr., Lt. & R. R., 7% pf.	99	97½	99½
Emerson Elec., pf.	b101	100	104½
Empire Dist. Elec., 6% pf.	l 88	82	88
Empire Power, A.	26½	21	32
Engr. Pub. Serv., pf.—no par.	94	94	96½
Engr. Pub. Serv., com.—no par.	m 21½	21½	24½
Eureka Vac. Cleaner, com.—no par.	53½	43	56
FAIRBANKS MORSE, pf.	k108	108½	115
Fairbanks Morse, com.—no par.	47	46	59½
Federal Lt. & Trac., com.	32½	28	39½
Federal Light & Traction, pf.	k 90	86	91½
Federal Utilities, pf.	m 70	....	....
Federal Utilities, com.	m 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l108½	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	61½	....	....
Galveston-Hstn. El., com.	25	....	....
Gen. Elec., com.	86½	79	95½
Gen. Elec., special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	45	34	59
Gen. G.&E., (Del.) com. B no par.	m 45½	45	48½
Gen. G.&E., (Del.) A pf. $8 no par.	k111	105½	113
Gen. G.&E., (Del.) A pf. $7 no par.	k 97	95	99½
Gen. G.&E., (Del.) pf. B.	k 93½	92½	96
General Public Service, pf.	m104	90	106½
General Public Service, com.	12	12	16½
Ga. Lt., Pwr., & Rys., 6% pf.	95	82	98
Ga. Lt., Pwr. & Rys., com.	m 70	65	80
Ga. Ry. & Power, 8% pf.	k114	112	114
Ga. Ry. & Power, 7% pf.	106	....	....
Ga. Ry. & Pwr., 4% pf.	k120	105	145
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	104½	....	....
Ill. No. Utilities, 6% pf.	a 91	90	92
Ill. Pwr. & Lt., 7% pf.	98½	....	....
Ingersoll Rand	97	80½	105
Int. Combus. Engr., com.—no par	42½	33½	64½
Int. Utilities, class A—no par.	31½	25	39
Int. Utilities, class B—no par.	5	3½	9½
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	96	96½	99
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	97	....	....
Jersey Central Pwr. & Lt., pfc., pf.	109	95½	112
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	145½	130	165

Stock Exchange: aChicago; bSt. Louis; ePhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Saturday, Oct. 2. lBid, low, high, Wednesday, Oct. 6. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Oct. 5	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	111¼	107¼	112¼
Kansas Gas & Elec., 7% pf. ex. div.	*l*103	99	103
Kentucky Hydro-Elec., pf.	*a* 93½	91¼	95½
Kentucky Sec., 6% pf.	80	..	....
Kentucky Sec., com.	100	....	....
Kentucky Utilities, 6% pf.	93	90	95
Keystone Pwr. & Lt. 7% pf.	96	95	97
LACLEDE GAS LT., com.	160½	146	175½
Lehigh Pwr. Sec., com.—no par	16	10	22
Long Island Ltg., 7% pf.	108½	....	....
Long Island Ltg., com.—no par	120	120	150
Los Angeles Gas & Elec., 6% pf.	98½	....	....
Louisville Gas & Elec., Class. A	23½	22½	26½
MANHATTAN ELEC. SUPPLY.	69	56	87½
Manila Elec., com.—no par	44½	27½	45½
Maytag Mfg., com.	22½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	108	103	109
Metro. Edison, pf.—$6—no par	93½	....	....
Metropolitan Edison, pf., $7, no par.	102½	....	....
Metropolitan Edison, com., no par.	50	45	50
Middle West Utilities, 7% pf.	*a*106½	97	111½
Middle West Utilities, 7% pr. lien pf.	*a*116	106½	123½
Middle West Utilities, com.—no par.	*a*115½	108	134½
Midland Utilities, pr. ln. pf.	*a*100	98	104
Midland Utilities pf. A	*a* 97	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	*a* 98	100	102
Milwaukee Elec. Ry. & Lt., 6% pf.	91	87	88½
Minn. Pwr. & Lt., 7% pf.	*l*104½	100	104
Miss. Pwr. & Lt., pf.	104	....	....
Miss. River Pwr, 6% pf.	95	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	102	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par	101	....	....
Mohawk Hudson Pwr., com.—no par	25½	20½	28½
Montana Pwr., pf.	*m*117½	112½	119½
Montana Pwr., com.	79	69½	83½
Montreal Pwr., com.	*f* 72½	....	....
Mountain States Pwr. pf.	97	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFLOK, LTG., pf.	99	....	....
National Carbon, pf.	*a*125½	125	128
National Electric Pwr-A.	*a* 23	19½	26½
National Elec. Pwr., pf.	*k* 93	93	95
Nat. Lt., Ht. & Pwr., com.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	102½	96	102½
National Pwr. & Lt., com.—no par.	20½	16½	38½
National Pub. Serv., 7% pf.	90	....	....
National Pub. Serv., pfc. pf.	110	....	....
National Pub. Serv., A com.—no par.	19½	15½	24
National Pub. Serv., B com.—no par.	*k* 16	10	16½
Nebraska Pwr., 7% pf.	*l*108½	103	107½
Nevada-Calif., Elec., com.	*m* 25½	18½	44½
New Brunswick Pwr., pf.	55	30	55
New England Pub. Serv., pr. ln. pf.	99	96	100½
New England Pub. Serv., pf.	92	88	94
N. J. Pwr. & Lt., 7% pf.	108	104	110
New Orleans Pub. Serv., 7% pf.	103½	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	89½	....	....
N. Y. Central Elec., 7% pf.	98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	109	98	114
Niagara Falls Pwr., 7% pf.—25	28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	109	110	111½
No. Amer., 6% pf.—50	51½	49	52½
No. Amer., com.—10	52½	42	67
No. Amer. Edison pf.—no par	95½	91½	96½
No. Amer. Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	*m* 94½	89	96
No. American Utilities, pf., 25% pd.	*m* 19	18	27
N.C Pub. Serv., pf.—$7—no par	92½	....	....
Northeastern Pwr., com.	17	16½	36½
No. Indiana Gas & Elec., pf. A	102	98	103
No. Indiana Public Service—pf.	101	99	103
No. N. Y. Utilities, 7% pf.	104	....	....
No. Ohio Pwr., com.—no par	12½	11	26½
No. Ohio Trac. & Lt., 6% pf.	78	78	81
No. Ohio Trac. & Lt., 7% pf.	94	88	96
No. Ont. Lt. & Pwr., pf.	83	....	....
No. Ont. Lt. & Pwr., com.	73	45	75
No. States Pwr., 7% pf.	101½	99½	103½
No. States Pwr. com.	106½	97	136½
No. Texas Elec., 6% pf.	61½	....	....
No Texas Elec., com.	25	....	....
OHIO BRASS, com. B—no par	76	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	94	92	95
Ohio Pwr., 6% pf.	95	93	96
Ohio Pub. Serv., 6% pf.	*l* 94½	90	96½
Ohio Pub. Serv., 7% pf.	*l* 99	96	100
Ohio River Edison, pf.	101	....	....
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	100	....	....
Pacific Gas & Elec. com.	130½	118	133½
Pacific Pwr. & Lt., 7% pf.	*l*102½	98	102½
Parr Shoals Pwr., 7% pf.	92	....	....
Penn Central Lt & Pwr., pf.—no par	*c* 72½	70½	91
Penn-Ohio Edison, 7% pf.	95	....	....
Penn-Ohio Elec., 7% pf.	95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	98	....	....
Penn-Ohio Pwr., & Lt., 8% pf.	109	....	....
Penn Pwr. & Lt.—$7—no par.	*l*108	103	108½
Penn Pub. Serv., 7% pf.	103	96	103
Penn Pub. Serv., 6% pf.	87	85	90
Penn Wtr. & Pwr., com.	*e*167	141	171
Phila. Co., 6% pf.—50	*c* 50	48½	50½
Phila. Co., com.—50	*k* 72½	59½	76½
Phila. Elec., com.—25	*c* 50½	41½	67½
Pittsburgh Utilities, pf.—10	*m* 19½	14½	20½
Portland Elec. Pwr., 7% pf.	99	....	....
Portland Elec. Pwr., 6% pf.	84	....	....
Portland Elec. Pwr., 6% 2nd pf.	71	....	....
Portland Elec. Pwr., com.	27	....	....
Potomac Elec. Pwr., pf.	*j*107½	....	....
Pwr. Corp. of N.Y., com—no par.	*m* 79	77½	90½
Pwr. Sec., pf.—no par.	*k* 24	10	29
Pwr. Sec., com.—no par.	*k* 6	4	13
Pub. Serv. of N. J., 7% pf.	108	103½	109½
Pub. Serv. of N. J., 8% pf.	*k*122½	115	123½
Pub. Serv. of N. J., com.—no par.	93½	72	97½
Pub. Serv. of No. Ill., 6% pf.	*a*102	100½	106
Public Serv. of No. Ill., 7% pf.	*a*114½	112	116½
Pub. Serv. of No. Ill., com.—no par	*a*132½	128½	140
Pub. Serv. of No. Ill., com.	130	126	135
Pub. Serv. of Okla., 7% pf.	98	92	97
Pub. Serv. Elec. & Gas, 6% pf.	*k*102½	97	104½
Public Service Elec. Pwr., pf.	*k*112½	106	114
Puget Sound Pwr. & Lt., 7% pf.	103	....	....
Puget Sound Pwr. & Lt., 6% pf.	83	....	....
Puget Sound Pwr., & Lt., com.	28	26½	66½
RADIO CORP. OF AM., pf.—50	49½	44½	49½
Radio Corp. of Amer., com.—no par.	55½	32	57½
Republic Ry. & Lt., pf.	108	....	....
Republic Ry. & Lt., com.	87	....	....
Rochester Gas & Elec., 5% pf.	*k* 95	80	98
Rochester Gas & Elec., 6% pf.	102½	100	103
Rochester Gas & Elec., 7% pf.	104	105	107
SAN JOAQUIN LT. & PWR., 7% pf.	97	97½	98½
Safety Cable, com.	50½	42½	55
St. Joseph Ry., Lt., Ht. & Pwr., pf.	67	60	70
Servel Corp.	16½	14½	22½
Sierra Pacific Elec., com.	25½	23	28½
Sioux City Gas & Elec., 7% pf.	99½	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	*l* 99½	....	....
Southeastern Pwr. & Lt., pfc. pf.	*l* 68	....	....
S. E. Pwr. & Lt., com.—no par.	31½	20	46½
So. Calif. Edison, 8% pf.—25	33	32½	33½
So. Calif. Edison, 7% pf.—25	27½	....	....
So. Calif. Edison, 6% pf.—25	24½	....	....
So. Calif. Edison, com.	31½	30½	33
Southern Cities Utilities, 7% pf.	85½	85½	91½
Southern Cities Utilities, com.	33	....	....
Southwestern Lt. & Pwr., A.	60	....	....
Southwestern Lt. & Pwr., B.	60	....	....
Southwestern Lt. & Pwr., $6 pf.	80	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*104	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	97	95	100
Standard Gas & Elec., 8% pf.	55½	53½	57½
Standard Gas & Elec., 7% pf.	103	....	....
Standard Gas & Elec., com.—no par.	53½	51	69
Standard Pwr. & Lt., 7% pf.	95	....	....
Staten Island Edison, pf.—$6—no par	96	....	....
Superheater, com.—no par.	158	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com.	365	260	355
TAMPA ELEC., com.	50	....	....
Tenn. Elec. Pwr., 6% pf.	90	....	....
Tenn. Elec. Pwr., 7% pf.	102½	....	....
Terre Haute, Ind. & East Trac., pf.	20	20	37
Terre Haute, Ind. & East. Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	*l*108	102	107½
Tide Water Pwr., 8% pf.	103½	....	....
Timken Roller Bearing, com—no par	64½	44½	64½
Toledo Edison, 8% pf.	*l*113	111	113
Toledo Edison, 7% pf.	*l*102½	101	103
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88	87½	89
UNITED GAS & ELEC., 6% pf.	98	....	....
United Gas & Elec., com.—no par	*m* 57	56	66
United Gas & Elec. (N.J.), 5% pf.	71	....	....
United Gas Impr.—50	*c*112½	84½	144½
United Lt. & Pwr. pf.—$4—no par.	52	44	51
United L. & P. pf.—$6.50—no par.	87½	81	91
United Lt. & Pwr., com., A—no par	*a* 13½	13½	26
United Lt. & Pwr., com., B—no par	*a* 18½	15	31
Utah Pwr. & Lt., 7% pf.	*l*103	99	103½
Utica Gas & Elec., 7% pf.	104½	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A.	30½	28½	37
Utilities Pwr. & Lt., com. B—no par	13½	13½	18½
VERMONT HYDRO - ELEC., 7% pf.	95	94	96
Virginia Elec. & Pwr., 7% pf.	105	103	106½
Virginia Pwr., 7% pf.	*k*108	102	104
Virginian Pwr., com.	*k* 70	65	75
WAGNER ELEC., pf.	*b* 70	61½	85
Wagner Elec., com.—no par.	*b* 23	13½	34½
Washington Ry. & Elec., com.	*j*190	....	....
Washington Ry. & Elec., pf.	*j* 90	....	....
Washington Wtr. Pwr., com.	134	130	136
West Mo. Pwr., 7% pf.	92	....	....
West Penn., 7% pf.	*m*115	108	115
West Penn, com.	*m*125	118	130
West Penn Elec., pf.	*k*101	95½	101
West Penn Elec., Class A.	*k* 94	88½	98
West Penn Pwr., pf.	*k*113	108	115
West Va. Lt., Ht. & Pwr., 7% pf.	94½	95	98
West Va. Utilities, 7% pf.—50	46	43	48
Western Pwr., 7% pf.	99	91½	99
Western States Gas & Elec., 7% pf.	92	....	....
Western States Gas & Elec., com.	16	....	....
Westinghouse El. & Mfg., com—50	69½	65	79½
Weston Elec. Instrument, Class A.	*k* 32	27½	32½
Weston Elec. Instrument, com.	*k* 19	13½	19½
Wheeling Elec., pf.	93	91	97
Wis. Pwr., Lt. & Ht., 7% pf	*k* 95	85	90
Worthington Pump, pf. A	*k* 64	66	80
Worthington Pump, pf. B	*k* 54½	53	65
Worthington Pump, com.	*k* 32½	20½	44½
YADKIN RIVER PWR., 7% pf.	*l*108	102	107½
Yale & Towne, com.—25	*k* 70	60½	72½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Saturday, Oct. 2. *l*Bid, low high, Wednesday, Oct. 6. *m*Latest quotations available.

Empire Gas & Electric Increases Capital.—The Empire Gas & Electric Company, Geneva, N. Y., through Elmer B. Sanford and Henry R. Frost, attorneys, of New York City, has filed a certificate in the office of the Secretary of State increasing its capital from $5,500,000 to $10,000,000.

Nashville Railway & Light Elects New Directors.—Berry S. Spain, assistant secretary and assistant treasurer of the Nashville Railway & Light Company, and John C. Guild, vice-president of the Tennessee Electric Power Company, have been elected directors of the Nashville utility to succeed H. A. Batchelor and W. R. Cole, resigned.

Stockholders Vote Stock Increase.—Stockholders of the Columbus (Ga.) Electric & Power Company, meeting Sept. 16, approved the changes in capital set-up outlined in the Aug. 21 issue of the ELECTRICAL WORLD. The plan called for (a) an increase in the authorized capital stock from $9,750,000 to $11,750,000, the two-million-dollar increase to consist of 6½ per cent preferred stock, series C, and (b) an increase in the common stock from 52,500 shares of common, par $100, now issued and outstanding, to 262,500 shares without par value. Five new shares are to be issued in exchange for every common share of $100 par value.

Stone & Webster Move Investment Banking Department.—The investment banking department of Stone & Webster, Inc., Boston, is occupying new quarters at 49 Federal Street in that city, having been transferred from the present headquarters offices of the company at 147 Milk Street. As existing tenants of the Federal Street building locate elsewhere, other departments of Stone & Webster will move into this structure, which is one of the most commodious in the financial district of Boston. This is the fourth move Stone & Webster have made since the organization of the firm in 1889.

United Gas Improvement to Pay 25 per Cent Dividend.—Stockholders of the United Gas Improvement Company on Sept. 23 increased the authorized capital stock (par $50) from 1,639,941 shares to 2,036,528 shares and authorized the directors to declare a stock dividend of 25 per cent and to issue for that purpose 407,306 shares of capital stock, that figure being the amount of the present unissued capital stock plus such increase. The dividend is payable Nov. 15 to holders of record Oct. 15.

Japanese Utility Reports Income.—Net income of the Tokyo Electric Light Company of Japan for the year ended May 31, 1926, amounted to $13,753,153, as against a figure of $11,500,209 for the previous annual period, when con-

verted on a basis of 48 cents per yen, approximately the present rate of exchange. Gross revenue totaled $31,988,175, which compares with $26,857,482 in the preceding twelvemonth. The increase in earnings is explained partly by a normal increase in the growth of the company's business and partly by the acquisition of three new properties, namely, the Keihin Electric Power Company, the Teikoku Electric Light Company and the Fuji Hydro-Electric Power Company.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Abitibi Power & Paper, com.	$1	Oct. 20
Adirondack Power & Light, com.	.10	Sept. 30
Adirondack Power & Light, com.*	.10	Oct. 31
Adirondack Power & Light, com.*	.10	Nov. 30
Adirondack Power & Light, 7% pf.	1¾	Oct. 1
Adirondack Power & Light, 8% pf.	2	Oct. 1
Allis-Chalmers Mfg., com.	½	Nov. 15
Anaconda Copper	.75	Nov. 22
Arizona Power, 7% pf.	1¾	Oct. 1
Arkansas Light & Power, pf.	1¾	Oct. 1
Beloit Water, Gas & Elec., pf.	1¾	Oct. 1
Blaw-Knox, com.	3	Nov. 1
Canada Northern Power, pf.	1½	Oct. 15
Central Power	1½	Oct. 15
Cincinnati Gas & Electric	1½	Oct. 1
Cleveland Electric Illg., 6% pf.	1½	Dec. 1
Commonwealth Edison, cap.	$2	Nov. 1
Commonwealth Gas & Elec., pf.	$1.50	Oct. 15
Fall River Electric Light	.50	Oct. 1
Georgia Lt., Pwr. & Rys., pf.	1½	Oct. 1
Idaho Power, pf.	1¾	Nov. 1
Illinois Northern Utilities, pf.	$1.50	Nov. 1
Louisville Gas & Elec., 7% pf.	1¾	Oct. 15
Milwaukee Elec. Ry. & Lt., pf.	1½	Nov. 1
Mississippi Power & Light, pf.	2	Oct. 1
Mississippi River Power, pf.	1½	Oct. 1
Missouri Gas & Elec. Serv., pr. lien	$1.75	Oct. 15
Ottawa-Montreal Power, pf.	1¾	Oct. 15
Pittsburgh Transformer, pf.	2	Oct. 1
Pittsburgh Transformer, com.	2	Oct. 1
Pittsburgh Transformer, com. (ex.)	2	Oct. 1
Power Corp. of Canada, pf.	1½	Oct. 15
Public Service of Northern Ill., 6% pf.	$1.50	Nov. 1
Public Service of No. Ill., 7% pf.	$1.75	Nov. 1
Pub. Serv. of No. Ill., com. ($100 par)	2	Nov. 1
Pub. Serv. of No. Ill., com. (no par)	2	Nov. 1
San Diego Con. Gas & Elec., pf.	1¾	Oct. 15
Southern Colorado Power	.50	Nov. 25
Texas Louisiana Power, pf.	1¾	Oct. 1
Tri-City Railway & Lt., com.	1	Oct. 1
Tri-City Railway & Lt., pf.	1½	Oct. 1
United Electric Light (Springfield)	3	Sept. 30
Washington Water Power 6½% pf.	1⅝	Dec. 15

* Monthly.

Recent Listings.—The New York Stock Exchange authorized the listing on or after Oct. 1 of common stock (par $15) of the Federal Light & Traction Company not exceeding $60,794 on official notice of issuance as a stock dividend, making the total amount applied for $6,140,231 in common stock. The listing of additional first and refunding mortgage 5 per cent gold bonds, series C, of the Metropolitan Edison Company to the amount of $1,000,000 was also authorized, making the total amounts applied for as follows: Series B, 6 per cent, $6,080,000; series C, 5 per cent, $7,650,000. On official notice of issuance as a stock dividend, the New York Stock Exchange has authorized the listing on or after Oct. 1 of additional common stock of the North American Company to the amount of $994,920. First mortgage gold bonds, series G, of the West Penn Power Company, amounting to $18,500,000 and bearing interest at the rate of 5 per cent, have been authorized for listing. This latest addition makes the total amount of first mortgage gold bonds applied for $47,000,000, consisting of $8,500,000, series A 5 per cent, $12,500,000, series E, 5 per cent, $7,500,000, series F, 5 per cent and $18,500,000 series G, 5 per cent. Also included in the recent listings were 20-year 5 per cent gold bonds of the Westinghouse Electric & Manufacturing Company, totaling $30,000,000.

American Water Works Increases Earnings.—American Water Works & Electric Company, Inc., for the year ended July 31, 1926, reported consolidated gross earnings of $43,643,496, comparing with $39,513,144 for the previous year, an increase of $4,130,352. Gross income after operating expenses, maintenance and taxes amounted to $20,671,270. This compares with gross income after similar charges for the same period in 1925 of $17,843,080, an increase of $2,828,190. Earnings after reserves for renewals and replacements and available for dividends were $3,776,807. This is equivalent to $4.41 a share on the 632,122 shares of common stock outstanding as of July 31, 1926, or $4.60 a share on the average amount of common stock outstanding during the period, in both cases after allowance for first preferred dividend requirements has been made.

Company Reports

The following statements of earnings have been issued by electric light and power companies for August:

Name of Company	Gross Earnings for August 1926	1925
Baton Rouge Electric	$76,493	$65,078
Blackstone Valley Gas & Elec.	393,009	381,040
Cape Breton Electric	50,062	40,081
Columbus Electric & Power	297,907	220,935
Eastern Texas Electric	*545,133	*231,544
Edison Elec. Illg. of Brockton	131,343	125,162
El Paso Electric	*218,893	*200,825
Electric Light & Power of Abington and Rockland	52,068	48,532
Galveston-Houston Electric	396,779	330,525
General Gas & Electric	1,907,156	1,657,709
Jamaica Public Service	*53,607	*51,787
Lowell Electric Light	121,571	114,748
Manchester Trac., Lt. & Pwr.	218,701	193,731
Nevada California Electric	405,875	385,083
New Bedford Gas & Edison Lt.	314,342	290,345
Northern Texas Electric	202,096	185,823
Public Service Corp. of N. J.	7,719,522	7,343,642
Puget Sound Power & Light	1,082,833	1,021,576
Savannah Electric & Power	18[illegible]341	154,536
Sierra Pacific Electric	10[illegible]595	99,339
Southern Canada Power	113,090	99,663
Tampa Electric	378,872	256,224
Winnipeg Electric	416,048	388,939

* July

Cleveland Electric Sells Big Bond Issue

Rapidly Expanding Business Has Enabled Gross Revenues to Double and Net Earnings to Triple in Six Years—New Capital Obtained on 4.85 Basis

THE sale this week of $10,000,000 of 5 per cent general mortgage gold bonds by the Cleveland Electric Illuminating Company focuses attention upon one of America's larger successful utility enterprises. Cleveland Electric furnishes electric light and power for the city of Cleveland and adjacent industrial and suburban territory extending almost 100 miles along Lake Erie. The population served is more than 1,500,000. The company also provides steam for heating purposes to many of Cleveland's larger business buildings.

Growing with a rapidly expanding community, Cleveland Electric's gross earnings have more than doubled and net earnings have tripled since 1920. Net earnings of $10,437,369 for the year ended June 30 were approximately five times interest requirements. Gross and net earnings, in millions of dollars, grew at the following rate in six years:

	Gross	Net		Gross	Net
1920	10	3	1924	18	8
1921	14	4	1925	19	9
1922	13	5	1926	21	10
1923	16	7			

Since 1920 the company has paid dividends on its common stock at the rate of 10 per cent per annum. Depreciation charges, moreover, have been liberal, amounting to $10,058,000 during the seven years in question. For the last calendar year net income after all expenses and interest charges was sufficient to show earnings of $37.90 on preferred and $29.31 on common.

Including the new bond issue sold this week, the company's funded debt totals $40,000,000. The property equity behind this has been valued by the Ohio Public Utilities Commission at about $85,000,000. The debt is followed by junior securities which at present market quotations represent an equity of more than $65,000,000. There are two issues of preferred stock, series of 1892-97 and the series of 1923, both of which pay 6 per cent. The par value of outstanding common is $16,629,800, but the stock, which has a par value of $100, is currently quoted at 295. Total capitalization based on par values is $72,711,500. The funded debt is 56 per cent of this—slightly below the average. Capitalization is approximately three and four-tenths times gross earnings.

Bonds Called in October Total $33,040,000

Bonds of electric light and power companies called for payment in October in advance of maturity totaled $33,040,000. Of this sum $32,495,600 represents issues called in entirety, while the remainder represents issues called in part. A detailed list follows:

Issues	Due	Amount
Havana Elec Ry., Lt. & Pwr. 5s	1954	$9,420,000
Nevada-California Elec., B, 6s	1950	8,804,000
Arkansas Light & Power, 6s	1945	3,882,300
Arkansas Central Power, 6s	1948	3,500,000
Public Service of Colorado, conv. 7s	1933	1,949,900
West Virginia Utilities, 6s	1935	1,370,000
Wheeling Public Service, 6s	1952	1,179,000
Southern Indiana Gas & Elec., 7½s	1941	786,400
Interstate Utilities, 6½s	1928	500,000
Portland (Me.) Ltg. & Power, 7s	1931	500,000
Okanogan Valley Power, 6s	1939	248,000
Globe Light & Power, 6s	1929	156,000
Minnesota Elec. Lt. & Pwr., 7s	1942	100,000
Litchfield Elec. Lt. & Pwr., 7½s	1935	100,000
Commonwealth Power, 6s*	1947	309,400
Cincinnati Gas & Electric, 5s*	1956	86,000
Cincinnati Gas & Electric, 7s*	1961	46,500
Vermont Hydro-Electric, 6s*	1929	50,000
Tennessee Electric Power, 6½s*	1933	38,500
Central Illinois Utilities, 6s*	1932	14,000

* Not entire issues.

Manufacturing and Markets

Trend in Prices of Electrical Materials

Data Cover Manufacturers' Selling Prices of Representative Electrical Commodities—Figures National in Character and Not Influenced by Local Conditions

SUPPLEMENTING the figures first published in the Feb. 16, 1924, issue of the ELECTRICAL WORLD, there is now presented the price index of electrical materials at manufacturers' selling prices brought up to July, 1926. These statistics, obtained from a fully authoritative source, contain comparative data on manufacturers' selling prices of a number of representative electrical commodities. The information is given in the form of index figures based on 1914 prices, making it possible to arrive at the manufacturers' selling price of any one of the items for any date since 1914 if the price is known for any period between 1914 and 1926. The prices are the average for the months as shown, and they check with those previously published except in three instances where slight corrections were made.

The figures are, of course, national in character and are not influenced by local conditions which may exist or which may have existed during the period mentioned in any section of the country. The index numbers are, generally speaking, a comparison of the prices of unit quantities of a typical size, type or design of an item in each particular line representative of the whole. The index numbers, therefore, are quite accurate in showing the price movement in such items as wire, batteries, rigid conduit, tapes and compounds, and standard porcelain, but there has been some difficulty in getting a true index of items that have shown marked changes in type and design during the period.

While all the items entering into the general group of commodities known as "electrical supplies" are not included in the accompanying table and diagrams, the thirteen items for which data are given cover a large percentage of the electrical supplies manufactured. The composite figures, as given in the table, differ from those previously published. The present figure is a weighted index and a composite of the specific thirteen items. Lamps and code wire, having a low index, weight the average heavily because of their large volume, and thus make the composite figure exceptionally low.

Fig. 1 shows clearly the extent to

PRICE INDEX OF ELECTRICAL MATERIALS AT MANUFACTURERS' SELLING PRICES,
(Based on 1914 Prices = 100)

	1914	1915		1916		1917		1918		1919		1920	
	Year	Jan.	July	Jan.	July	Jan.	July	Jan.	July	Jan.	July	Jan.	July
Weatherproof wire	100	102	137	168	207	235	234	187	200	180	147	187	193
Pole-line hardware	100	100	100	100	151	215	215	239	239	239	194	217	275
Iron and steel wire and strand	100	101	101	112	118	122	163	205	205	205	205	205	205
Bare copper wire	100	104	145	180	193	222	221	175	193	160	145	142	142
Power apparatus	100	100	100	110	113	131	144	148	163	165	155	155	163
Incandescent lamps	100	95	86	86	86	86	86	95	95	95	95	95	127
Dry batteries	100	100	170	153	170	170	170	194	218	194	218	218	218
Rubber-covered wire (code)	100	89	95	105	133	151	140	133	148	148	127	139	142
Flexible cords	100	103	104	123	164	225	224	210	216	226	202	241	262
Rigid conduit	100	86	102	112	137	165	247	247	234	229	214	214	223
Schedule material	100	103	108	119	136	171	171	171	171	199	199	199	216
Tapes and compounds	100	100	100	100	100	111	137	161	243	211	211	246	292
Standard porcelain	100	100	100	80	118	136	165	185	206	206	139	278	348
Electrical supplies (composite figure)	100	96	102	110	127	146	153	153	142	160	147	155	173

	1921		1922		1923		1924		1925		1926	
	Jan.	July	Jan.	July	Jan.	July	Jan.	July	Jan.	July	Jan.	July
Weatherproof wire	140	108	107	107	120	127	116	110	124	114	117	114
Pole-line hardware	259	195	161	170	190	206	185	173	173	164	153	167
Iron and steel wire and stand	237	202	156	158	172	197	187	187	176	170	161	161
Bare copper wire	118	116	105	116	127	131	111	108	124	116	121	120
Power apparatus	188	151	142	130	130	137	136	133	133	126	126	126
Incandescent lamps	127	127	127	111	101	92	92	74	72	72	72	71
Dry batteries	243	200	200	194	194	194	194	194	194	194	194	194
Rubber-covered wire (code)	105	84	88	82	90	96	90	82	93	89	99	85
Flexible cords	182	139	120	117	133	147	138	121	121	117	117	117
Rigid conduit	214	179	143	145	170	192	192	192	182	182	182	182
Schedule material	216	199	142	128	150	171	156	156	156	155	155	129
Tapes and compounds	228	186	183	163	180	180	194	174	169	169	154	149
Standard porcelain	348	222	222	133	133	120	108	120	120	97	97	97
Electrical supplies (composite figure)	159	139	128	119	125	130	125	116	118	114	115	113

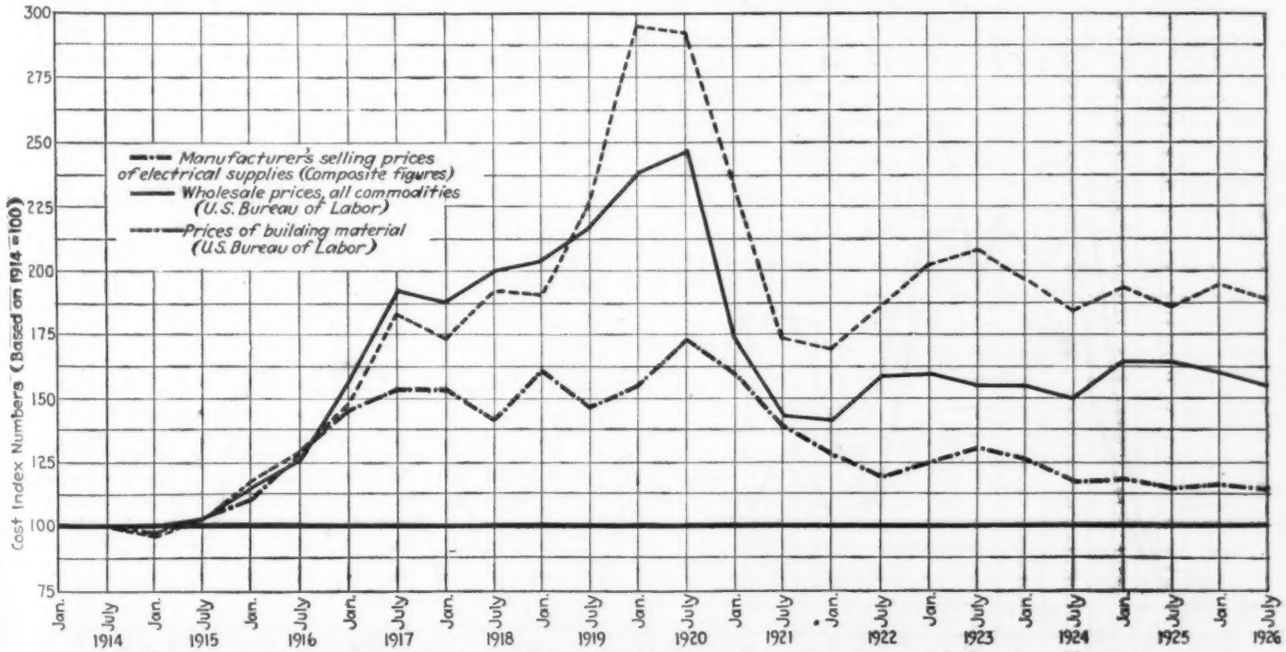


FIG. 1—COMPARATIVE PRICE INDEXES OF ELECTRICAL MATERIAL, ALL COMMODITIES AND BUILDING MATERIAL

Manufacturer's selling prices on standard porcelain
Manufacturer's selling prices of pole-line hardware
Cost Index Numbers (Based on 1914=100)
2

Manufacturer's selling price of weatherproof wire
Manufacturer's selling price of iron and steel wire and strand
Cost Index Numbers (Based on 1914=100)
3

Fig. 2—The price of pole-line hardware was lower in January, 1926, than at any time since July, 1916.

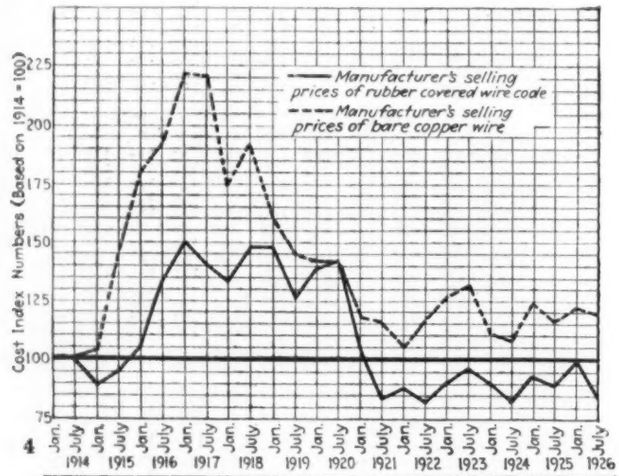
Fig. 3—Weatherproof wire reached the peak with an index of 235 in January, 1917, but in July, 1926, its index was 114.

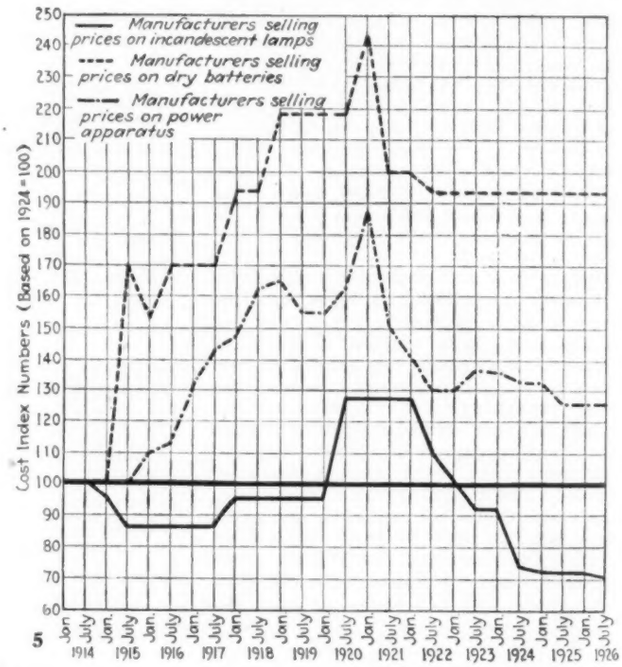
Fig. 4—In July, 1926, the index price of rubber-covered code wire was 85.

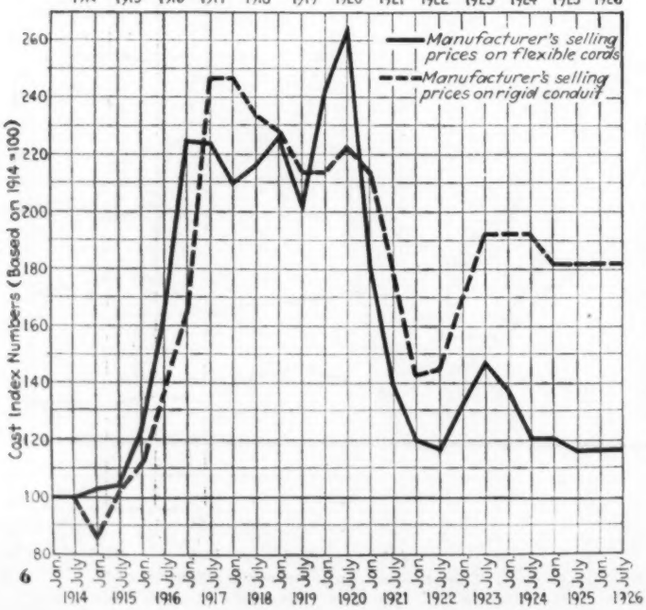
Fig. 5—In July, 1926, incandescent lamp prices were only 71 per cent of the 1914 price.

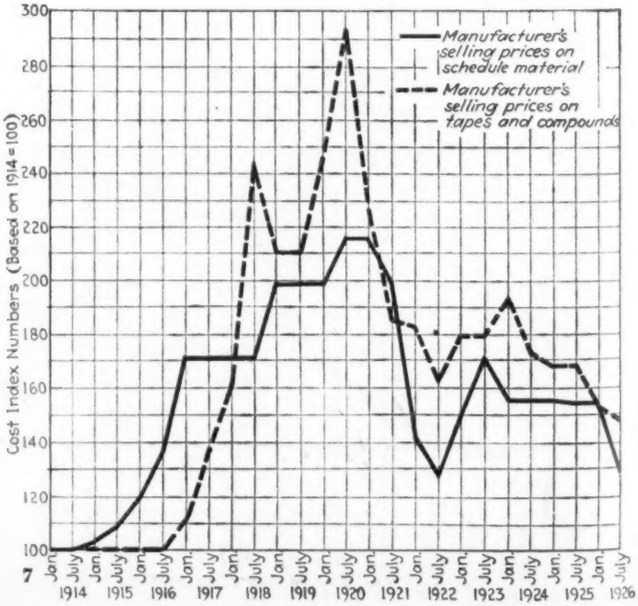
Fig. 6—Prices of flexible cords and rigid conduit more than doubled from 1917 to 1921.

Fig. 7—Both tapes and compounds and schedule material have registered declining prices in the last three years.


Manufacturer's selling prices of rubber covered wire code
Manufacturer's selling prices of bare copper wire
Cost Index Numbers (Based on 1914=100)
4


Manufacturers selling prices on incandescent lamps
Manufacturers selling prices on dry batteries
Manufacturers selling prices on power apparatus
Cost Index Numbers (Based on 1924=100)
5


Manufacturer's selling prices on flexible cords
Manufacturer's selling prices on rigid conduit
Cost Index Numbers (Based on 1914=100)
6


Manufacturer's selling prices on schedule material
Manufacturer's selling prices on tapes and compounds
Cost Index Numbers (Based on 1914=100)
7

which the prices of electrical supplies as a whole have been held down by manufacturers since 1914, as compared with the wholesale prices of commodities and the high prices asked for building materials. During the peak year of 1920 the increase in the price of electrical supplies was considerably less than that of all commodities or building material. In July, 1926, the composite figure for electrical supplies was 113 and compares with 154 for all commodities and 187 for building material.

The prices of wire varied considerably in the various classes. The prices of weatherproof wire followed very closely the prices of bare copper wire. Weatherproof wire, after a steady price increase, witnessed the greatest gain with a 135 per cent increase in 1917. On the other hand, rubber-covered code wire actually decreased in price during 1915, only reached a maximum point of 51 per cent above 1914, and in July, 1926, was 15 per cent below the 1914 price. With the exception of incandescent lamps this is the only item for which a price lower than that of 1914 was recorded in July, 1923.

The price of pole-line hardware remained very close to the pre-war figure through the first of 1916. It then took a distinctly upward swing, reaching the peak price in July, 1920, of 175 per cent above the 1914 figure. The price in July, 1926, was only 67 per cent above that of 1914. The price of standard porcelain, after reaching a figure in July, 1920, and January, 1921, of 248 per cent above that of 1914, since July, 1925, has been steady and has been 3 per cent below the 1914 price.

The price of incandescent lamps was downward until 1918, and the maximum price since 1914, recorded in 1921, has been only 27 per cent above that year and has shown a steady decrease since the opening of 1922. In July, 1926, the price was 29 per cent below the 1914 figure, and on Sept. 1 a further reduction in prices was announced. This last reduction amounted to about 7 per cent on the sizes generally used of the new standard line of lamps and approximately 5 per cent on all types.

European Electrical Market Expanding Rapidly

Expansion in the European electrical industry and an anticipated increasing demand is presaged by the thirty-million-dollar loan being negotiated by American bankers for one of the large German electrical manufacturers. The abeyance of activities in these fields during and after the period of the World War is becoming less evident, and conditions are steadily improving so that the European market for electrical equipment is increasing. Russia and Italy have been active in developing hydro-electric plants, and several large transmission lines have been built or are under way as a result. At the close of 1925 Italy's generating capacity was almost double that of five years previously, and at the present time the rate of increase is greater. Russia's program involves a series of thirty regional generating stations planned for completion in the next few years as a first step toward the electrification of the Soviet Union. Eight of the thirty stations are now in full or partial operation. A survey of the Dneiper and Southern Boug Rivers has been undertaken by an American firm of consulting engineers with a view to utilization of the available water power.

Process as Patentable as Piece of Machinery

A process, if new and useful, is just as patentable as a piece of machinery. This decision of Justice Bradley in the leading case of Cochrane vs. Deener (94 U. S. 780) was quoted by Judge Bodine in the District Court of New Jersey in deciding a suit brought by the General Electric Company against Charles Eisler and the Eisler Engineering Company, Inc. The patents in suit were the Mitchell and White patents, Nos. 1,423,956 and 1,423,957, for tipless incandescent lamps, and they were held not infringed in this case.

Quoting further from Justice Bradley's decision above referred to, the court said: "The machinery pointed out as suitable to perform the process may or may not be new or patentable, while the process itself may be altogether new and produce an entirely new result. The process requires that certain things should be done with certain substances and in a certain order; but the tools to be used in doing this may be of secondary consequence." The court also quoted from the opinion of Chief Justice Taft in Thropp's Sons Company vs. Seiberling (264 U. S. 320 and 328) and held it to be applicable in this case as follows:

"The change from hand to the use of machinery often involves invention. In the making of tires it has in fact resulted, because of the use of power, in speed of manufacture and possibly in some greater uniformity of the product. But the record does not show that there has been substantial change in the mechanics or methods of making. The steps are the same, the succession from one to the other is as in the manual art, and the transfer from hand to power was by the usual appliances and had all been indicated before the state patent."

Business Conditions

MANUFACTURERS report that the trend of business in the industry is favorable, and in virtually all sections of the country a good volume of business is being transacted. Sales are made up of many diversified orders, general supplies and equipment are in demand, and many orders are being placed for general-purpose motors. Several inquiries have also been received by manufacturers for quotations on "white-way" equipment. Railroad firms are active, and a large order for motor coaches and electric locomotives was placed by one company. Further orders are also expected from such sources within the month.

In New England there is a continued demand for general supplies and equipment, and small motors are selling well. An order for about $20,000 worth of plant control and power equipment was placed in western Massachusetts, and industrial electric heating activity is becoming more pronounced. Sales are spotty in the New York district, with the demand active for elevator motors and central-station distribution equipment. Railroad firms are active, and further orders are expected from such sources. Diversified orders in the Southeast aggregate a good volume. Several "white-way" projects are also active in that district. In the St. Louis district sales of motors are good. The volume of business is reported up to normal but has included no large orders. Sales in the Middle West are on a steady, even basis and indicate good business during the last quarter of the year. On the Pacific Coast September sales are reported better than those of August but below expectations. A large order covered 50,000 standard 10-in. suspension insulators and was placed with two manufacturers. Many inquiries have been received from pulp, paper and lumber mills, although sales to such companies were light.

Copper and Zinc Sales in Better Volume, but Prices Weaken

Copper and zinc sales registered an improvement, but the prices of virtually all the non-ferrous metals weakened. Sales have been largely the result of active efforts to tempt consumers at concessions in price. No actual sales of copper were reported under 14.20 cents, delivered Connecticut, and 14.30 cents in the Middle West, though 14¼ cents might have been paid in the East had a consumer been willing to place an attractive order for a large tonnage. There has been a little more tendency than before to buy for December shipment; in fact, January shipment has been specified in some instances. The same price has obtained, regardless of time of delivery.

The American Smelting & Refining Company made two cuts in its official price for New York lead. On Friday, Oct. 1, a reduction of $2 per ton brought the price from 8.75 cents per lb. to 8.65 cents, and on Oct. 6, a further cut of $3 per ton made the price 8¼ cents. The feature of the market is the almost entire absence of business for forward delivery. Most of the purchasers specify prompt delivery with a modest amount bought for the second

NEW YORK METAL MARKET PRICES

	Sept. 29, 1926 Cents per Pound	Oct. 6, 1926 Cents per Pound
Copper electrolytic	14¼	14.15
Lead, Am. S. & R. price	8⅛	8⅛
Antimony	14¼	13¼
Nickel, ingot	35	35
Zinc spots	7¾	7.65—7.70
Tin, Straits	70¼	71¼
Aluminum, 99 per cent	27	27

Base copper price Oct. 6, 1926, 16¼ cents.

half of October. The weakness is as usual attributable in a measure to the persistent decline in the London market. There is practically no spot Straits tin to be had and the market is largely nominal. In common with other metals, zinc prices have been gradually receding during the last two or three weeks, although there is no immediate likelihood of its getting any lower.

Sales in Middle West on a Steady, Even Basis

Business in the Middle West continues on a steady, even basis. Indications are that the last quarter of the year will be prosperous and equal to, if it does not surpass, the record of the same period last year. Strong buying in the agricultural districts is noted as well as an increase in employment in industrial manufacturing concerns. Sales of electrical energy in the Indiana district show an increase of 25 per cent over the same period last year. The various utility companies are actively engaged in construction work, and purchasing of apparatus is quite large. Among the interesting orders placed were one for sixteen 5,000-kva. oil-immersed, self-cooled power transformers and another for 150 single-phase, 96-kva. automatic induction-feeder voltage regulators. There has been a steady demand for maintenance material for repairs in the flooded areas in southern Illinois. The coal-mining sections continue to show increased activity. Jobbers' sales remain satisfactory. There has been a remarkably good demand for conduit fittings.

Sales of Motors Active in the St. Louis District

In the St. Louis district small motors easily lead in sales during the week. While the volume of business in most lines is reported up to normal, there have been very few orders of any size. Two interesting orders were placed with one of the jobbing houses for wiring supplies and equipment for two good-sized buildings in Alton, Ill., totaling something more than $10,000, and another large order was placed for high-tension switching apparatus to be installed in a power station at Ste. Genevieve, Mo. The demand for electrical appliances continues good. One jobber reports a spurt in the sales of ironing machines and states that other electrical merchandise is moving in good volume. Christmas orders for appliances are being booked in good quantity. The present weak spot in the district's business is line construction materials. This is partly explained by the fact that no small distributing companies are doing any building and the large companies have purchased their requirements in advance.

Sales Spotty in New York District —Elevator Motors Active

General industrial buying in the New York district shows a falling off, especially for motors and control equipments up to 10 hp. There is, however, some improvement in the sales of motors for elevator service, and a number of inquiries are reported for equipments for ice plants. Central-station buying is slow, there being very little demand for generating equipment and transformers. Sales of distribution equipment are somewhat better, a fair volume of distribution transformers being purchased. Business in switching equipment is dull, and the demand for poles, cross-arms and hardware is considerably below normal. Railroad firms are active, and it is expected that further orders from this source will be placed within the week. Jobbers report all lines comparatively quiet and somewhat spotty.

Steady Buying Marks Trend in New England Trade

Continued demand for general supplies and equipment is noted in the New England district. Small motors are selling well and the volume of buying to date is quite encouraging as compared with last year. During the past week a number of fair-sized orders were reported, one for more than 100 units, another for 60 motors and several calling for between 20 and 30 machines. Power-equipment, switch and control apparatus sales are in good volume. An order for about $20,000 worth of plant-control and power equipment was placed during the week in western Massachusetts, and several negotiations are under way for similar orders which are the result of new municipal contracts acquired by central-station companies.

Industrial electric heating activity is more pronounced owing to the resumption of metal working and the manufacturing of products requiring heat treatment. One manufacturer is busy with a number of orders recently received and has a good volume of inquiries on hand. Small lead pots are selling very well, and a number of type-melting pots have been recently ordered. Street electric lighting is receiving considerable attention, with over a dozen projects under consideration. Industrial electric lighting interests is being turned from new-construction projects to improved layouts. As compared with last year, the negotiations on hand are easily equal in number to the volume, and much activity is foreseen. Household electric appliance sales maintain a good showing. Several campaigns under way are producing good results.

September Sales Better on Pacific Coast

Jobbers report that September business on the Pacific Coast was considerably better than that of August, though below expectations. Railroad purchasing is light, the only outstanding orders being for 15,000 cable rings and 30,000 ft. "Tirex" cable, the latter being part of an order for six proportionate items covering special cables and magnet wires. Power company purchasing has included one carload of deep-groove double-petticoat glass insulators, one carload locust pins, 100 line switches for 7,500-volt service, one carload creosote, and many small inquiries were received for assorted pole-line hardware for particular repair or maintenance jobs. The outstanding recent order covered 50,000 standard 10-in. suspension insulators placed with two manufacturers. A large fixture order covered $8,000 worth of lighting units for the 30-story Russ building in San Francisco. Miscellaneous machinery orders covered $2,000 worth of motors and control devices for the new Dumbarton drawbridge near Redwood City and a lighting installation for the same amounting to about $1,500. A substation switchboard costing about $7,500 and three-feeder voltage regulators amounting to about $12,500 were also purchased, as well as four arc-welding outfits, at about $1,250 each, for miscellaneous industrial plants.

Seattle jobbers, with one exception, report light sales last week, although several inquiries were received from the larger pulp, paper and lumber mills. The sale of $30,000 worth of apparatus to a pulp and paper corporation at Shelton was reported. The same firm also reported that a contract was awarded for installing a five-hundred-thousand-dollar lumber mill at Medford, Ore. The city of Seattle is taking bids for 10,000 ft. of No. 8 duplex wire cable and 10 miles of copper trolley wire.

Diversified Orders Aggregate Good Volume in Southeast

Despite the fact that during the past week no large individual orders have been reported, the general trend of business has been satisfactory, with the volume not disappointing, owing to a large number of diversified orders received from the territory at large. The recent Florida hurricane has resulted in good orders for poles, wire, pole-line hardware and distribution transformers for shipment to the storm area. Though as yet little activity is to be noted in Florida orders for house-wiring supplies, it is anticipated that sales of this line will improve as soon as débris can be cleared away. Very satisfactory orders for incandescent lamps and "white-way" glassware are also being received. Throughout the section generally central-station orders for socket appliances are in good volume, though the majority of the orders are for late October and early November delivery for holiday sales. Portable lamps are being campaigned by a number of the larger power companies, and this is stimulating the activity of the line generally. Several "white-way" projects are active, and the next few weeks will probably see orders placed for this equipment, which has been in little demand for several weeks past. There is a scattering of highway lighting business also in prospect. One of the larger municipalities in north Georgia has under consideration the installation of an automatic traffic signal system.

Sales of high-tension line materials are reasonably active in Georgia, and portions of Alabama and one order for oil switches amounting to approximately $50,000 will probably be placed within the next ten days. High-tension transformer equipment in the moderate sizes are in reasonably good demand, especially in voltages up to 44,000 primary. High-tension insulators, in active demand until ten days ago, have shown a slump in sales volume. Purchases by industrial plants are quiet, though contracts amounting to about $40,000 were let by a textile company.

Activities of the Trade

Westinghouse Receives Large Orders for Equipment

Several large orders received by the Westinghouse Electric & Manufacturing Company have been announced by E. D. Kilburn, vice-president of the company. An order has been received from the Southern California Edison Company for a synchronous frequency-changer set which will cost $250,000. This set is of the 50-cycle to 60-cycle type, is rated at 30,000 kva. and will operate at 600 r.p.m. The unit will be equipped with two direct-connected exciters, two Griscom-Russel air coolers, starting auto-transformers and regulating equipment.

The company has also received an order from the Georgia Railway & Power Company for five type G-22 400-amp., 110-kv. oil circuit breakers. Other orders include one from the Washington Water Power Company for three type 0-33 2,000-amp., 15-kv., two type 0-33 600-amp., 15-kv., and one type G-11 400-amp., 110-kv. oil circuit breakers. The Consolidated Electric Light & Power Company, Baltimore, also ordered six type 0-331 oil circuit breakers rated 400 amp. at 47 kv., and the Inspiration Consolidated Copper Company ordered two type 0-221 oil circuit breakers rated 800 amp. at 15 kv. and two type SV arresters for 15-kv. service.

The Premier Vacuum Cleaner Company announces that William G. Keay has been appointed New England sales representative with headquarters at 120 Boylston Street, Boston.

The Wodack Electric Tool Corporation, 23 South Jefferson Street, Chicago, announces that it has placed on the market the new Wodack electric hand-saw.

The Howell Electric Motors Company, Howell, Mich., is perfecting plans for the early construction of a new one-story addition to its plant, 40 ft. x 200 ft. The company will also build another one-story extension, 130 ft. x 140 ft.

The General Electric Company has appointed Thomas B. Knight district manager at its Boston office, succeeding Charles B. Davis, who has resigned. Mr. Knight for several years has been assistant district manager at the Boston office.

The Walker & Pratt Manufacturing Company, 31 Union Street, Boston, manufacturer of ranges, is now building a substantial addition to its factory to take care of increased electrical range business. The company is also building a new enameling plant for the enameling of electric ranges.

The Graybar Electric Company, 100 East 42d Street, New York City, announces that it has published the National Electrical Code in combination with Robert Goelier's cross-index, and the publication, in the form of a hand pocket-size booklet, is available at any of the company's 58 distributing houses.

E. I. Dupont de Nemours & Company, Wilmington, Del., has developed a synthetic plastic, known as "Pyradiolin," which can be used for making standard push-button and toggle plates as well as floor plug plates for lamps and other accessory attachments. It is available in various colors.

The Corning Glass Works, Corning, N. Y., announces that it has recently received an order for 5,000 "Pyrex" high-tension power-line insulators from the Montana Power Company, Butte, Mont. These insulators are for 50,000-volt service. The company states that the Montana utility has been using "Pyrex" insulators for approximately three years.

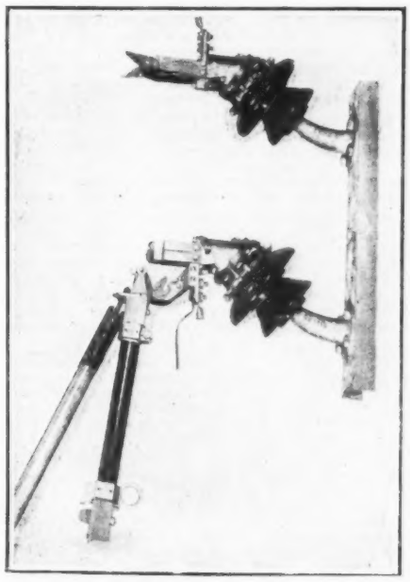
The Mogadore Insulator Company, Mogadore, Ohio, manufacturer of electrical porcelain, is said to be considering the construction of a new plant at Coventry, Ohio, which will be one-story, 110 ft. x 300 ft.

The Electric Storage Battery Company, Philadelphia, has awarded a general contract for its proposed one-and-two-story factory branch and distributing plant at Chicago Avenue and Woodlawn Street, Detroit, 110 ft. x 250 ft., to cost close to $100,000 with equipment.

New Equipment Available

Expulsion Fuse "Disconnects"

A new line of outdoor fuse "disconnects" has been developed by the Electrical Engineers' Equipment Company of Chicago. The line comprises the type FV, which is constructed with insulator units inclined upward at 55 deg., and the type FVH with insulator units mounted at 90 deg. to the base. Otherwise the two types are the same. The distinctive feature of both types is the detachable fuse holder, which can be removed from and replaced in the mountings by using a switch hook with a special detaching prong. The accompanying illustration shows one of these devices with a switch hook engaged in the fuse holder just being removed from the mountings. The fuses are built on standard pin insulators for voltages from 7,500 to 73,000 and are available in capacities up to 75 amp. The type FVH fuse disconnects are identical with the type FV except that the insulators are mounted at 90 deg. to the base instead of 55 deg. All parts except the insulator units themselves are thus directly interchangeable with the parts of the type FV disconnect.



THE TYPE FV FUSE "DISCONNECT," SHOWING THE TUBE WHEN IT HAS JUST BEEN DETACHED

The fuse link used in connection with this device is inclosed in a live rubber tube. The presence of this rubber tube about the fuse link protects the porcelain tube from the heat of the fuse wire. It also absorbs some of the mechanical shock caused by blowing under short circuits. When the fuse operates the rubber tube is expelled, taking with it all of the molten fuse metal and practically all of the charred portions caused by the electric arc, thus preventing the inside of the tube from becoming coated with any of the conducting material formed when the fuse blows.

Tests made by a large operating company on this fuse show it to be capable of successfully interrupting short-circuit power varying from 5,000 kva. to 16,000 kva. This device can also be used with "S. & C." chemical fuses. The hinge and jaw hardware are provided with bosses on which "S. & C." fuse clips can be mounted, and the center lines of these bosses are the same as the center-lines of "S. & C" fuses.

Outdoor Meter Cabinets

A complete line of steel meter cabinets placed on the market by the Packard Electric Company, Warren, Ohio, is now available for use in conjunction with outdoor primary metering installations and can be used with the Packard type PCW metering sets where the set must be placed outdoors. The cabinets are all steel-welded with the entire front forming a hinged door. The walls are of heavy-gage copper-bearing steel, and standard transformer hanger irons are furnished so that the cabinet may be easily mounted at the base of a pole. A "Kondu" threadless conduit nipple is provided at the bottom of each cabinet so that the conduit carrying the secondary meter cable may be quickly connected. The manufacturer states that any size cabinet can be furnished for special meter combinations, but that the usual requirements can be met with the three standard sizes that are available.

New Trade Literature

CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued revised leaflets L 3,549-B, L-20, 135-A, and L 20,011-A, covering type CA carbon circuit breakers, types CL and CN carbon circuit breakers, and types F-11 and F-22 oil circuit breakers, respectively. Application, construction and operation of these various types of circuit breakers are described and illustrated in these leaflets.

BRACES.—The Brundy Engineering Company, Inc., 10 East Forty-third Street, New York City, is distributing a bulletin entitled "Truss the Bus" in which it describes and illustrates the Brundy braces for use in connection with high-tension transmission lines.

AIR COMPRESSORS.—Bulletin GEA-233 issued by the General Electric Company, Schenectady, N. Y., covers the "G-E" centrifugal single-stage air compressors. This bulletin contains illustrations of the compressor in a gas plant and details of construction of same. Curves made from tests on a listed machine showing characteristics of the compressor are included.

SAFETY SWITCHES, POWER PANELS, ETC.—The Square D Company, Detroit, Mich., has issued catalog No. 36, covering its products, including safety switches, switch boxes, motor starter, porcelain insulators, power panels, test plugs and sockets, voltage testers, etc. Tables giving dimensions of switch boxes in inches and knockout sizes and locations and wiring data for motors are included.

INSULATING BRICK.—"Sil-O-Cel Insulating Brick" is the title of bulletin No. 103 issued by the Celite Products Company, 11 Broadway, New York City, in which it describes the four types of the "Sil-O-Cel" brick as follows: The standard brick for service where the insulation will be subjected to temperatures no higher than 1,600 deg. F.; C-22 brick for service where insulation will be subjected to temperatures between 1,600 deg. and 2,000 deg. F.; superbrick for use under severe conditions where the insulation may be subjected to temperatures as high as 2,500 deg. F., and the rotary kiln brick designed especially for the insulation of rotary cement and limekilns. This bulletin also contains a description of methods used in bonding walls where insulation is employed.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Prince Rupert, Canada (No. 22,354), of electric floor polishers and electric refrigerators.

An agency is desired in Leipzig, Germany (No. 22,311), for electric household appliances, electric refrigerators; also for refrigerating plants and ice machines (No. 22,322).

Purchase and agency are desired in Sofia, Bulgaria (No. 22,297), of installation materials, electrical.

Purchase is desired in Calgary, Canada (No. 22,360), of meat-slicing machines.

Purchase and agency are desired in Berlin, Germany (No. 22,342), of electric refrigerators.

An agency is desired in Alexandria, Egypt (No. 22,320), for electrical wire; also for electric drills for submarine use (No. 22,323).

Purchase is desired in Durango, Mexico (No. 22,361), of X-ray equipment and accessories.

An agency is desired in Prague, Czechoslovakia (No. 22,325), for hand and electrical boring machines (finer parts only).

WATER-TUBE BOILERS WITH SUPERHEATERS, ETC., FOR AUSTRALIAN POWER PLANT.—Specifications have been issued by the State Electricity Commission of Victoria, Melbourne, Australia, inviting bids on water-tube boilers with superheaters, economizers, etc. The date of closing is Dec. 15. Copies of these specifications will be on sale when received at the New York District Office, 734 Custom House, and the Chicago District Office, 35 South Clark Street, of the Bureau of Foreign and Domestic Commerce, Department of Commerce. The price will be three guineas ($15.33) for a set of three copies, which charge will be returned to bana-fide bidders.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS. — Contract has been awarded by W. F. Schraft & Sons Corporation, 160 Washington Street, North, for the construction of an addition to its factory and power house at Medford Street, Sullivan Square, to cost about $1,500,000.

DANVERS, MASS. — Plans have been prepared by the Electric Light Department for the installation of an ornamental lighting system on Danvers Square, consisting of twenty-eight lamps of 1,500 cp. and thirty-two lamps of 1,000 cp.

MAYNARD, MASS.—Cellulose Products, Inc., recently organized to take over the property of the American Powder Mills, Inc., plans to install electric power equipment in connection with proposed extensions in the local plant, to cost about $200,000.

Middle Atlantic States

BINGHAMTON, N. Y. — An appropriation of $277,500 has been approved by the State Hospital Commission for improvements to the Binghamton State Hospital, of which $3,000 will be used for extension of the outside lighting system.

BROOKLYN, N. Y.—Bids will be received by John J. Dorman, fire commissioner, Eleventh Floor, Municipal Building, New York City, until Oct. 11 for construction of a portion of the underground fire-alarm system in the Borough of Brooklyn.

BROOKLYN, N.Y.—Bids will be received by the Department of Public Welfare, Tenth Floor, Municipal Building, New York City, until Oct. 11 for construction and material for additions and alterations to the power house and boiler plant at Kings County Hospital, including general construction, heating, electric work and plumbing.

BUFFALO, N. Y.—Bids will be received by the State Hospital Commission, Albany, until Oct. 13 for construction, heating and electric work, of two additions to an existing building and entitled extension to Elmwood Buffalo State Hospital, Buffalo.

CANEADEA, N. Y. — The contract for the construction of the proposed power dam at Caneadea for the Rochester (N. Y.) Gas & Electric Corporation has been awarded to the Gannett Seley & Fleming Corporation, Harrisburg, Pa., at $810,000.

CAZENOVIA, N. Y.—Authority has been granted the Cazenovia Electric Company to make extensions to its electric plants in the towns of Cazenovia, Fenner, Nelson, Lincoln and Sullivan and to exercise of franchises heretofore granted by the local town officials.

FAIRPORT, N. Y.—Permission has been granted the municipality of Fairport to extend the transmission lines of the municipal electric plant outside of the village for the purpose of supplying electric service to the Fairport Cold Storage Company.

GENEVA, N. Y. — The Public Service Commission has granted the Empire Gas & Electric Company permission to make extensions to its electric plants in the towns of Fleming and Sennett, and to exercise the franchises granted by these towns to the Auburn Light, Heat & Power Company, the latter company having been merged with the former.

HEMPSTEAD, N. Y.—The Nassau & Suffolk Lighting Company has petitioned the Public Service Commission for permission to construct an electric plant and to furnish electricity in that part of the town of Hempstead known as Island Park and including all or part of Barnum Island; also to include that part of the town known as Oceanside.

SEWARD, N. Y.—The electric plant of the Seward Electric Light & Power Company was recently destroyed by fire, causing a loss of about $6,000.

SYRACUSE, N. Y.—Permission has been granted the Syracuse Lighting Company to extend its electric service in the town of Pompey. The existing franchise of the company covers only a limited territory in the town.

TRIBES HILL, N. Y.—The Adirondack Power & Light Corporation, Schenectady, is negotiating with the village authorities for the installation of a street-lighting system here.

UTICA, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Oct. 27, for furnishing and installing an electric generator at the Utica State Hospital.

CALDWELL, N. J.—Bids will be received by the Board of County Freeholders, Court House, Newark, until Oct. 13, for electric power plant equipment in connection with a proposed rock crusher installation at the local penitentiary, and for which bids will be received at the same time. Henry Berg, Administration Building, Overbrook, is plant superintendent.

EAST ORANGE, N. J.—A committee has been appointed by the Chamber of Commerce of the Oranges and Maplewood to secure better street lamps in the Oranges and Maplewood. The elimination of gas lamps now in use is under consideration.

ELIZABETH, N. J.—The installation of two electrically-operated pumping units of 1,000,000 gallons daily capacity in connection with extensions to its water system is contemplated by the Middlesex Water Company.

AMBRIDGE, PA.—The Duquesne Light Company, Pittsburgh, has completed plans for the construction of a substation in Ambridge.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 19, for lever switches for the Philadelphia and Mare Island navy yards, (Schedule 6046).

PITTSBURGH, PA. — The Duquesne Light Company has acquired property on Second Avenue, in the Glenwood district, where it is planning to build a new substation.

PITTSBURGH, PA. — Bids will be received by the Montefiore Hospital, Pittsburgh, and Schmidt, Garden & Martin, architects, 104 South Michigan Boulevard, Chicago, for construction of a hospital building, medical building and power house with wing in rear, including vacuum steam heating plant. The cost is estimated at $1,500,000.

BERLIN, MD.—The City Council has issued $10,000 in bonds, the proceeds to be used for extensions and improvements in the municipal electric power plant.

SYKESVILLE, MD. — A franchise has been granted to the Consolidated Gas, Electric Light & Power Company, Baltimore, which has recently acquired the local light and power system. The company plans extensions in transmission lines in this section.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 12, for electric soldering irons and glue pots, etc.

WASHINGTON, D. C.—Bids will be received by the Commissioners of District of Columbia, 509 District Building, until Oct. 15 for power plant, heating system and plumbing, near Laurel, Md.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, until Oct. 19, for motors, controllers, ventilating sets and spare parts (Schedule 6047).

WASHINGTON, D. C.—Bids will be received by the Director of Public Buildings and Public Parks, until Oct. 21, for the installation of an improved lighting system in the Lincoln Memorial.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Clerk, Department of Commerce, Nineteenth Street and Pennsylvania Avenue, Washington, D. C., until Oct. 12 for establishing twenty-four electric revolving searchlight beacons and nine intermediate landing fields, for use by the Department of Commerce.

North Central States

HANOVER, MICH. — The Southern Michigan Light & Power Company, Hudson, which has been granted a franchise in Hanover, Horton and vicinity, plans extensions in its transmission lines in this section.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Oct. 15 for single-conductor, lead-covered cable, and for fibre conduit for the Division of Light and Power. Separate proposals to be submitted on each item.

CLEVELAND, OHIO.—At an election to be held Nov. 2 the proposal to issue $110,000 in bonds for fire-alarm signal system; $115,000 for storage batteries and switch boards; $30,000 for 22 miles of underground lead cable; $100,000 for police and fire signal shop and traffic division station, etc., will be submitted to the voters. W. R. Hopkins is city manager.

COLUMBUS, OHIO.—Bids will be opened on Oct. 11 for the installation of ornamental lamps on High Street from the north corporation line to Arcadia Avenue and from Fifth Avenue to the South Corporation line. The project will cost about $200,000, and lamps of 3,000, 1,500 and 600 cp. will be installed.

HAZARD, KY.—Arrangements are being made by the Kentucky & West Virginia Power Company for the erection of transmission lines from Hazard to Jackson, via Chavies, Yerkes and Krypton, a distance of 40 miles.

NORTONVILLE, KY. — The Kentucky Electric Power Company, which is making extensions and improvements in its local steam-operated electric power plant, will install additional equipment.

DEPUTY, IND. — Permission has been granted the Madison (Ind.) Light & Power Company by the Commissioners of Jefferson County to erect transmission lines along and over the highways in the town of Deputy.

EVANSVILLE, IND.—Plans are under consideration by the Waterworks Board for the installation of new pumping equipment and other power equipment in connection with proposed extensions and improvements to the municipal water system, to cost about $1,270,000.

GARY, IND.—Bids will be received by the Board of Public Works until Oct. 11 for the installation of street lamps along Broadway from the north line of the Wabash Railroad to the north line of Twenty-third Avenue. The work will include 123 combined trolley pole lamp standards completely equipped; 6,400 lin.ft. two-duct fibre conduit encased in concrete; 6,400 lin.ft. of four-duct fibre conduit encased in concrete; 1,250 lin.ft. of 6-duct fibre conduct encased in concrete; 5,900 lin.ft. 2½-in. galvanized steel conduit; 148 manholes, 35,000 lin.ft. No. 8 gage, 5,000-volt cable, 14,000 lin.ft. No. 10 gage 600-volt cable, 246 600-1,000 cp. transformers with necessary potheads, lamps, brackets, etc.

LINCOLN, ILL.—The Lincoln Water & Light Company has applied for authority to supply electricity for light and power in Beason.

SPRINGFIELD, ILL.—The Central Illinois Public Service Corporation has applied to the Public Service Corporation for permission to extend its transmission line from Kinderhook to Liberty, and also for authority to purchase the municipal electric plant and system in Liberty.

APPLETON, WIS.—The erection of a transmission line from Hortonville to Hortonia is under consideration by the Wisconsin Traction, Light & Power Company.

MENOMINEE, WIS. — Plans are under consideration by the Northern States Power Company for repairs and improvements to its local dam, to cost about $50,000.

CEDAR RAPIDS, IOWA. — Contracts have been awarded by the Iowa Railway & Light Company for the construction of a power house at Armstrong and Petersen.

SIOUX CITY, IOWA.—The Platte Valley Power & Light Company, Sioux City, Iowa, has been granted permission to erect a 2,300-volt transmission line in Dakota County, across the river in Nebraska, to supply electricity in newly developed territory.

WATERLOO, IOWA.—The Roth Packing Company is considering the installation of a cold storage and refrigerating plant in connection with extensions in its packing house, to cost about $500,000. Henschein & McLaren, 1637 Prairie Avenue, Chicago, are architects.

CALIFORNIA, MO.—The Missouri Utilities Company contemplates extensions and improvements to its transmission lines, to cost about $10,000.

JEFFERSON CITY, MO.—The construction of an electric plant with a capacity of 360 kw. and an electric distribution system in Jefferson City is under consideration by the Jefferson Electric Corporation. The proposed plant will be driven by oil engines.

SPRINGFIELD, MO.—The installation of an ornamental lighting system on Booneville Avenue is under consideration by the Booneville Avenue Improvement Association.

WILLIAMSVILLE, MO.—The Missouri-Arkansas Power Company has been granted a franchise to install an electric distribution system and supply electricity here.

DAVENPORT, N. D.—The City Council has disposed of a bond issue, the proceeds to be used for the erection of a transmission line to supply electricity for municipal service.

DEVILS LAKE, N. D.—Plans are under way by the Otter Tail Power Company, Fergus Falls, Minn., for extensions of its transmission lines to serve Finley, Aneta, Sharon, Kloten and McVille. The proposed lines will carry 40,000 volts.

SHERWOOD, N. D. — The Montana-Dakota Power Company, Fairmont, Mont., has been granted a franchise by the City Council to erect a transmission line for local light and power service. Connection will be made with the power line near Mohall, about 12 miles distant.

BUTTE, NEB. — Authority has been granted the Tri-State Utilities Company, Minneapolis, Minn., to erect a transmission line from Butte to the South Dakota Line, where it will make connections with its own lines.

GORDON, NEB.—Permission has been granted the Nebraska Electric Power Company, Davenport, Iowa, to build a 13,200-volt transmision connecting the village of Gordon, where it has acquired the municipal electric plant, with Clinton, Rushville and Hay Springs, where it has contracts to supply electric service to the municipalities.

GRANT, NEB.—Plans have been prepared by the City Council for the construction of a municipal power plant, for which bids will be called for soon. J. F. Reynolds, United Bank Building, Sioux City, Iowa, is architect.

HARTINGTON, NEB.—Application has been made by the Hartington Electric Light Company for authority to issue $75,000 in bonds to finance the construction of a plant in Hartington.

RIVERTON, KAN.—The Empire District Electric Company, Joplin, Mo., contemplates extensions and improvements in its local steam-operated electric power plant, to include the installation of a 35,000-hp. turbine generator and auxiliary equipment, to cost about $1,000,000, including transmission line construction.

Southern States

DALLAS, N. C.—Plans are under way for improvements to the municipal electric light and power system, for which $15,000 in bonds have been issued.

NINETY-SIX, S. C. — The Ninety-Six Cotton Mill plans to install electric power equipment in a proposed addition to its mill, to cost about $200,000. J. E. Sirrine & Company, Greenville, are engineers.

ALBANY, GA. — The South Georgia Power Company is considering erecting transmission lines in Cuthbert, Shellman, Dawson and Sasser to Albany.

ATLANTA, GA.—The Georgia Utilities Company, a subsidiary of the Georgia Railway & Power Company is building electric distributing systems in the towns of Silver Creek and South Lindale to furnish electrical service in those places.

COHUTTA, GA.—The Georgia Railway & Power Company, Atlanta, which recently acquired the plant of the Cohutta Light & Power Company, contemplates extension to its transmission lines in this section.

KINGSLAND, GA. — The Ware County Light & Power Company, Waycross, plans extensions in its transmission line to this vicinity to furnish electrical service in a number of communities.

WAYCROSS, GA. — The Ware County Light & Power Company plans to build an electrically-operated ice plant of 150 tons daily capacity, and a storage capacity of 8,000 tons, to cost about $100,000.

DELAND, FLA.—Work will soon begin on the installation of an ornamental lighting system on West New York Avenue, consisting of 156 lamps. The new standards will be installed by the Florida Public Service Company, Orlanda, which furnishes electrical service here.

SEBRING, FLA.—Bonds to the amount of $10,000 have been voted for extensions and improvements in the street-lighting system.

CHATTANOOGA, TENN.—The Southern Cities Power Company is planning to erect electric transmission lines in Bledsoe County.

JOHNSON CITY, TENN.—The Empire Chair Company plans to install electric power equipment in its proposed local plant addition, to cost about $200,000.

BIRMINGHAM, ALA.—E. I. duPont de Nemours & Company, Inc., Wilmington, Del., is planning the construction of a power plant in connection with its proposed explosive manufacturing works, to be erected on site about 10 miles from the city. The cost of the project is estimated at $400,000.

RIDERWOOD, ALA.—The E. E. Jackson Lumber Company plans to install electric power equipment in connection with the rebuilding of its mill, recently damaged by fire, with loss of about $100,000.

LAUREL, MISS.—The installation of an ornamental lighting system on Fourth Avenue is under consideration by the City Council.

MORTON, MISS.—The Mississippi Power & Light Company, Jackson, plans to install an electric lighting system in Morton.

PASCAGOULA, MISS.—The Mississippi Ice & Utilities Company plans to install electric power equipment in connection with extensions in its ice and refrigerating plant.

JONESVILLE, LA.—Contract has been awarded by the City Council for the construction of an electric plant and sewerage system. A. E. Joseph, Glenmora, is engineer.

LAKE CHARLES, LA.—The installation of an ornamental lighting system is under consideration by the Lake Charles Association of Commerce.

LAKE CHARLES, LA.—Plans are being considered by the Louisiana Electric Company, Inc., for the erection of a 33,000-volt transmission line from Lake Charles to Lake Arthur, a distance of about 12 miles.

WELSH, LA. — The Louisiana Electric Company, Lake Charles, plans to install electric power equipment in a proposed local ice-manufacturing plant, to cost about $50,000.

CUSHING, OKLA. — Citizens failed to ratify a proposed bond issue of $12,000, for the installation of an ornamental lighting system in the downtown section.

MONETTE, OKLA. — Plans are under way by Earl W. Baker & Company, 408 Medical Arts Building, Oklahoma City, for the erection of a 6,600-volt transmission line from Monette to Byars. The project includes a distribution system in Byars, transformer and substations in both towns, and a 1,500 ft. span across river.

PONCA CITY, OKLA.—The Ponca City Milling Company plans to install electric power equipment in its proposed flour mill and elevator, to cost about $450,000. Horner & Wyatt, Board of Trade Building, Kansas City, Mo., are architects.

BAY CITY, TEX.—The Texas Central Power Company, San Antonio, plans to install electric power equipment at its proposed local ice-manufacturing plant.

BROWNSVILLE, TEX.—A special election will be held on Oct. 16 to vote on the proposal to issue $35,000 in bonds for extensions and improvements in the municipal electric plant.

DEL RIO, TEX.—The Central Power & Light Company, San Antonio, is considering the installation of a Diesel engine and auxiliary equipment in its local power plant.

TERRELL, TEX. — The City Council plans to purchase an oil engine direct connected to alternator, and auxiliary equipment for the municipal electric plant.

Pacific and Mountain States

STEVENSON, WASH.—Application has been made by W. H. Hufford, Stevenson, and associates for permission to build a hydro-electric power plant on the Wind River, a tributary of the Columbia River, to cost about $250,000, with transmission system.

TACOMA, WASH.—The Board of Public Works has taken out a permit for the construction of a substation at 1016 North Sixth Street.

DUNSMUIR, CAL.—Plans are under way by the City Council for the installation of a municipal fire-alarm system.

LOS ANGELES, CAL.—A petition has been presented to the City Council asking permission to install ornamental lamps on Maryland Street, between Boylston Street and Lucas Avenue.

REDLANDS, CAL.—The installation of an ornamental lighting system on Grant Street, between Brookside and Fern Avenues, and on Citrus Avenue between Sixth and Church Streets, is under consideration by the City Council.

RICHMOND, CAL.—Plans are under consideration by the Ford Motor Company, Highland Park, Detroit, for the construction of a power plant at its proposed local assembling works. The cost of the entire project is estimated at $600,000.

SAN FRANCISCO, CAL.—The Great Western Power Company, 530 Bush Street, San Francisco, has petitioned for a license for a transmission line in Plumas and Butte Counties, crossing Plumas and Lassen National Forests.

BOISE, IDAHO.—Bids will be received by the United States Veterans Bureau, Arlington Building, Washington, D. C., until Oct. 26 for construction of refrigerating plant at the United States Veterans Hospital 52 at Boise.

HAZELTON, IDAHO.—The City Council is considering the installation of a municipal electric plant.

MURTAUGH, IDAHO. — Preliminary plans are under way by the Murtaugh Irrigation District for the construction of a hydro-electric plant, to cost about $500,000. H. T. Henderson is engineer.

HAYDEN, ARIZ.—Plans are under way for the erection of an electric transmission line from the local power plant of the Nevada Consolidated Copper Company to the Coolidge damsite to supply power in connection with the construction of the dam. The contract for the line has been sublet to the McClintock Marshall Company, Los Angeles.

HUMBOLDT, ARIZ.—The Southwest Metals Company, Tucson, plans to install electric power equipment in connection with a proposed local concentrating mill, to be equipped for an output of 250 tons per day.

DENVER, COL.—Bids will be received by the Board of Water Commissioners, 1,509 Cleveland Place, until Nov. 1, for furnishing and installing the following equipment: One twenty-million gallon daily capacity motor-driven centrifugal pump for use at the Capitol Hill pumping station; one fifteen million gallon daily capacity motor-driven centrifugal pump for use at the Ashland Avenue pumping station, and one eight million gallon daily capacity motor-driven centrifugal pump for use at the University pumping station, all equipped with starter complete. All motors to be synchronous motors and to be wound for 4,000 volts, 61⅔ cycles, three phase current. Alternate bids are also asked for slip ring variable speed motors, to be wound for same service. D. D. Gross is chief engineer.

DURANGO, COL.—The Western Colorado Power Company has petitioned for a license to erect transmission lines in La Plata, San Juan, Sam Miguel, Ouray and Montrose Counties, crossing public lands and national forests.

OPHIR, COL.—W. R. Vanderveer, Ophir, has applied for a license to build a power plant in Bilk Creek in San Miguel County, crossing Montezuma County.

Canada

ROSSLAND, B. C.—The Consolidated Mining & Smelting Company of Canada, Ltd., has authorized the installation of two steam turbo-generators of 1,500 kw. each at the Sullivan concentrator to supply electric power.

ROSSLAND, B. C.—Plans have been approved by the West Kootenay Power & Light Company, Ltd., for the construction of a hydro-electric plant on the Kootenay River, about 1 mile from Lower Bonnington, to develop about 60,000 hp. The cost is estimated at about $3,000,000.

STELLARTON, N. S.—Arrangements have been made whereby the Pictou County Power Board will extend its transmission lines from Stellarton to Eureka and Hopewell. The cost is estimated at $20,000.

MISTASSINI, QUE.—Plans are being prepared by the Missassini Power & Paper Company for the construction of paper mills, to cost about $10,000,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 14, 1926)

1,599,631. DYNAMO-ELECTRIC MACHINE; H. Barnes, London, England. App. filed Sept. 9, 1924. The proportioning of the dimensions of the slots and teeth of the armature of a synchronous rotary converter in which a variation in the section of the conductor is made, and this proportioning is carried out in such a way that any material variation in the local reluctance of the path for the magnetic flux for a given position under the pole face as the different teeth move past that point is avoided. Such a variation would be liable to produce local currents in the short-circuited windings, which are usually arranged in the pole face of a rotary converter for the purpose of damping or starting, unless special steps were taken to prevent their occurrence. In a rotary converter arranged in accordance with the invention it is possible to utilize a short-circuited pole-face winding of the ordinary type in conjunction with an armature conductor arrangement in which the section is varied from point to point. The grading of the section of the conductor with appropriate changes in the dimensions of the slots in cases where the winding is arranged in slots will generally be done in steps in order to comply with practical requirements, the number of steps being limited by considerations of the relative advantage and cost of obtaining a more or less close approximation to uniform distribution of resistance losses. Where grading the section of the conductor is employed in connection with rotary converters having the armature winding arranged in slots of constant depth distributed around the core, the width of the slots will in general be varied in accordance with the grading of the conductor.

1,599,643. SAFETY GUARD FOR ELECTRIC SWITCHES; B. F. Burcham, Birmingham, Ala. App. filed Dec. 20, 1923. A guard or shield which will prevent contact with any part of the conducting material.

1,599,644. ELECTRICAL APPARATUS; G. A. Burnham, Saugus, Mass. App. filed April 29, 1924. An oil-immersed electric switch with an expansion chamber, the internal volume of which is relatively great as compared with the internal volume of the switch casing, to keep down the internal pressures within the switch. A switch having an open top inclosing casing adapted to contain the arc-quenching fluid in the bottom thereof and switch members extended through the casing below the open top, the top opening being at such a distance above the fluid level in the casing as to retain amounts of fluid that may be moved upwardly above the normal fluid level during circuit interruption.

1,599,645. METHOD OF TESTING MAGNETIZABLE OBJECTS; C. W. Burrows, New York, N. Y. App. filed Jan. 26, 1924.

1,599,668. CONTROLLING AND REGULATING APPARATUS FOR ENERGY CONVERSION MACHINES; F. W. Meyer, Milwaukee, Wis. App. filed Nov. 20, 1919. Means which impress a regulating effect upon the energy conversion machine substantially coincidental with the need therefor and remove such effect instantly when the effect is no longer needed.

1,599,679. DYNAMO-ELECTRIC MACHINE; G. Schroeder, West Byfleet, England. App. filed Sept. 9, 1924. In a synchronous converter the section of the conductor is varied from point to point around the core so that the greater section occurs where the higher effective current values are found, whereby the resistance loss taking place in the different conductors is rendered more uniform. This grading of the section of the conductor, with appropriate changes in the dimensions of the slots in cases where the winding is arranged in slots, will generally be done in steps in order to comply with practical requirements, the number of steps being limited by considerations of the relative advantage and cost of obtaining a more or less close approximation to uniform distribution of resistance losses.

1,599,701. ELECTROLYTIC APPARATUS; H. P. Ewell, Tacoma, Wash. App. filed Oct. 19, 1923. Apparatus utilizing the electrolytic decomposition of a salt in the production of an amalgam.

1,599,752. DYNAMO-ELECRIC MACHINE; V. A. Fynn, St. Louis, Mo. App. filed Nov. 9, 1923. A method of operating a motor which carries variable load at synchronous speed, comprising the production of a primary flux which revolves with respect to the primary, causing the primary flux to generate starting-torque-producing ampere-turns in a circuit on the secondary, producing an auxiliary voltage of slip frequency which becomes unidirectional and differs from zero at synchronism, and impressing the auxiliary voltage on the starting-torque-producing circuit on the secondary to produce a substantially unidirectional synchronizing torque.

1,599,753. DYNAMO-ELECTRIC MACHINE; V. A. Fynn, St. Louis, Mo. App. filed Nov. 9, 1923. In a dynamo-electric machine, a primary and a secondary without defined polar projections, a commuted and another winding on the primary, said other winding being adapted for connection to a polyphase supply, brushes carried by the secondary and co-operating with the commuted winding, and three windings on the secondary displaced by 120 electrical degrees, each of said windings forming part of an operatively closed circuit and one of said windings being connected to said brushes and deviating from that axis which is displaced by 90 electrical degrees from the brush axis.

1,599,754, 1,599,755. ALTERNATING-CURRENT MOTOR; V. A. Fynn, St. Louis, Mo. Apps. filed Nov. 26, 1923. In which a revolving field of more or less uniform magnitude is produced, at least during the starting period. Polyphase synchronous induction motor.

1,599,756, 1,599,757. SYNCHRONOUS MOTOR; V. A. Fynn, St. Louis, Mo. Apps. filed Feb. 4, 1924, and Feb. 18, 1924. In which a revolving field of more or less uniform magnitude is produced, at least during the starting period, and which derive their excitation from an exciter delivering unidirectional voltage at synchronism and slip-frequency voltage at other speeds. It also relates to the operation of machines provided with the type of exciter described, and more particularly it relates to polyphase synchronous induction motors.

1,599,758, 1,599,759, 1,599,760. SYNCHRONOUS MOTOR; V. A. Fynn, St. Louis, Mo. Apps. filed March 24, 1924, and April 4, 1926. Synchronous-induction motors of the self-excited or the separately excited type. In some of its aspects it is applicable to single as well as to polyphase motors, and it also relates to apparatus associated with dynamo-electric machines.

1,599,764. CIRCUIT-CONTROLLING DEVICE; H. E. Heller, Milwaukee, Wis. App. filed Nov. 20, 1922. A switch of the inclosed type having improved safety means associated therewith to insure opening of the switch prior to opening of the casing cover and also to insure against closure of the switch until after closure of the casing cover.

1,599,836. STORAGE BATTERY; R. B. Owen, Washington, D. C. App. filed May 10, 1920. Seals for the terminal posts.

1,599,912. ELECTRIC COOKING DEVICE; R. Naujoks, Berlin-Friedenau, Germany. App. filed April 4, 1924. An electric cooking device in which the heater proper is to be immersed or plunged into the respective liquid or other food. It is combined with a lid for the respective receptacles and provided with an automatic cutout for the heating current.

1,599,927. PROCESS OF UNITING THICK METAL PLATES BY ELECTRIC WELDING; R. Stresau, Wauwatosa, Wis. App. filed Jan. 12, 1923.

1,600,026. POWER-TRANSMITTING SYSTEM; W. Weiler, Niederschinhausen, Germany. App. filed March 24, 1926. Frequency changers. An arrangement for limiting the energy transmitted to a safe value without interfering with the ready interchange of energy between the different systems under normal conditions.

1,600,033. SELF-PROPELLED VEHICLE; J. C. Barry, Erie, Pa. App. filed Nov. 4, 1924. Wherein an internal-combustion engine drives a generator which in turn supplies current to electric motors connected to axles of the vehicle, and wherein a separate exciter is provided for the field of the generator and a storage battery is provided for the exciter for energizing its field when starting, the battery being charged by the exciter, although it is not necessarily limited thereto. In such systems the exciter voltage is higher than that required for charging the battery, making it necessary to insert a resistance in the battery-charging circuit. An improved arrangement avoids the losses incident to the usual charging resistance.